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Journal of Quantitative Methods

A step forward in data driven innovations



**School of
Business and
Economics**

Journal of Quantitative Methods (JQM) is a multidisciplinary journal published by the Department of Quantitative Methods (QM), School of Business and Economics (SBE), University of Management and Technology (UMT) Press, Lahore, Pakistan. JQM reports new insights and fosters critical debate about the role of data analysis in business and economics.

The quantitative aspect(s) of development with which the journal is concerned include: business analytics, data mining, data management, marketing, finance, human resource management, knowledge management, entrepreneurship, human development, socio-economic development and environmental sustainability.

JQM provides a unique forum and is a double blind peer-reviewed publication dedicated to the exchange of the latest academic research and practical information on all the aspects of quantitative methods in business and social sciences. The journal publishes original research papers, reviews and case studies by academics and professionals.

JQM seeks to help and furnish new evidence-based theories and understandings as it pertains to data science and its applications. It stresses the importance of appreciating the interplay of national and global contexts and dynamics in shaping and enhancing the role of quantitative methods in management decision making and socioeconomic development.

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“JQM’s mission is to share knowledge by publishing basic and applied research on data innovations in the fields of statistics, business and economics to explore the new horizons of thoughts, ideas, research techniques, tools and methods.”

VISION

“JQM envisions to lay out a scientific research publication forum which facilitates scholars, academicians and professionals to publish their work and build a vibrant and supportive community of scholars by significantly exploring opportunities to connect and explore ideas in the fields of statistics, business and economics.”

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Moreover, JQM strongly stimulates debate amongst scholars, researchers, practitioners and policymakers across the world with a view to define standardized practices and skills and evaluate effective responses for future challenges.

JQM further encourages guest editors to submit their proposals for special issues addressing specific areas included in the broad theme of the journal or resulting from relevant conferences. JQM will also consider theme-specific issues focusing on a particular country or a region.

FOCUS

The core focus of JQM is to promote the data driven innovations in various domains to provide guidance in decision making and present advanced statistical methods with insights on basic and applied quantitative methods, tools and techniques.

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- The focus of journal is on the interpretation of research and how the results of research may translate into practice.

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- Exploration of behavioral and managerial issues relating to all aspects of psychology and education from a global perspective.
- General and technical reviews on innovative subjects which inform and stimulate debate.
- Literature review or viewpoint on a particular topic or trend.

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Journal of Quantitative Methods (JQM) has been printed and published in collaboration with University of Management and Technology Press; dedicated for the dissemination of knowledge by printing the publications, allying and networking with the intellectuals, scholars and authors from diversified academic departments. UMT Press publishes original papers, reviews, books, corrections, clarifications and retractions on timely basis.

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Dear Colleagues

Education without innovative research and development is meaningless for the community. This is more so when we are intertwined globally and contribution to global knowledge is the call of the day. I feel highly motivated by the positive response from contributors and likeminded educational fraternities exhibiting their deep interest in bringing this first volume of Journal of Quantitative Methods to print.

JQM endeavors to provide a forum for academicians, researchers and practitioners who are interested in the discussion of data driven innovations and are keen to promote, share and publish relevant high quality research in the domains of statistics, business and economics.

Thus, JQM aims to promote the data driven innovations in various fields and provides assistance in decision making and presents the advanced statistical methods with insights on basic and applied quantitative methods, tools and techniques.

I would like to hear from you as well as your valuable suggestions on improving our journal further. I sincerely extend my thanks to contributors, editorial board members and looking forward for continuous support.

Profound Regards,

Editor-in-Chief
Dr. Maqbool Hussain Sial

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Quantitative Research and its Contemporary Directions

Sheraz Alam Malik¹

Field of business and economics has seen a surge in the big data applications in recent years. These advances have impacted the research direction significantly for both academics and practitioners as methods and theory underlying these applications are also changing. This is because factors affecting these applications are dynamic in both regional and international context (Davies & Hughes, 2014).

As complex social, political, economic and business factors affect quantitative research, a critical debate is needed to understand and apply them in evidence based scenarios. Therefore, a platform is needed to develop and understand the complexity involved in the interplay of these factors. JQM attempts to serve this important platform. However, we need to first briefly understand these factors before embarking on this important journey.

Starting from the social aspect of quantitative research, data science is impacting at different levels of human life (Bryman, 2015). This includes health sciences and related policy making, the debate around sustainability, environmental protection initiatives and cultural changes due to the digital revolution. These multi facet aspects have a profound impact on the future research direction of management sciences and economics (Cartwright & Schoenberg, 2006).

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Political factors play yet another role in shaping our lives by changing the debate around developmental initiatives in regional and international context, customer engagement on key policy issues, human development and budgetary allocation (Punch, 2013). Regional shifts in public mood affect the consumer behavior affecting the economy and business of the region. This requires in-depth investigations by academics to study its effects in these associated fields.

Similarly, economic factors like currency fluctuations due to the consumer based economy, the impact of major incidents on knowledge management and higher education sector, development of human resource due to big data insights and entrepreneurial ventures due to shared economy. All these diverse areas of knowledge require a strong quantitative approach to come up with meaningful answers and solutions along with new theoretical underpinnings (Sekaran & Bougie, 2016).

Business factors are the most relevant part of this platform as it is directly related to its core field of application of social sciences disciplines i.e. management and economics. Business models across the world are adapting to growing needs of society, customers, governments and environment surrounding them. This means no single theory or method is robust enough to explain these changes. Thus, a multidisciplinary approach is the only way to address these ever-changing phenomena and its possible investigation.

As business and economics are strongly interrelated, therefore viewing it from a single lens of quantitative research can result in an inaccurate analysis and flawed assumptions (Sekaran & Bougie, 2016). The more systematic approach will be to treat this discipline from the inherent complexity and interconnectivity point of view. This will give more leverage in seeing different strands of literature and its relevance to these two important discipline.

I will conclude by highlighting the fact that the focus of this research platform is futuristic both in theory and applications. This means the divergent and diverse point of views will be entertained resulting into new avenues of research and scholarship. This journal will advance the debate in every discipline of social science spanning from analytics, marketing, supply chain management to finance, human resources and economics. Evidence based theories will be in the very DNA of this platform and it will encourage originality both from academics and professionals from the fields of social sciences and its associated disciplines.

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Impact of Credit Constraints on Firms Growth: A Case Study of Manufacturing Sector of Pakistan

Mughees Tahir Bhalli¹
Shahid Mansoor Hashmi²
Arslan Majeed³

Abstract

This study explores the impact of credit constraint on growth by using firm level data of manufacturing sector of Pakistan for the period of 1974-2010 analyzing via Generalized Method of Moments (1991) one step and two step estimation technique. Result of full sample shows that the firms in manufacturing sector for the period from 1974-2010 are not facing external financial constraints and the effect of sale to capital ratio indicates the availability of investment opportunities for the firms in the manufacturing sector of Pakistan. The results for pre and post financial sector reform era shows that firms are facing tight external financial constraints in pre financial reform era as compared to post financial reform era. Results show that growth of firms having small assets is constrained by internal finance whereas firms having medium and large assets are not constrained by internal finance. Similarly, firms' growth that is less dependent on debt finance is constrained by internal finance whereas results for the firms that are moderately and highly aggressive in financing with debt indicate that the growth of firms belonging to these groups is not constrained by internal finance. Similarly, low dividend paying firms growth is constrained by internal finance whereas high dividend paying firms' growth is not constrained by internal finance.

Keywords: Manufacturing Sector, Credit, Investment, Growth, GMM

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1. Introduction

Economic growth has always been the central focus of many researchers. Complex econometric modeling was introduced from the past and is still valid to unfold the aspects which are directly or indirectly linked to the economic growth phenomena. Economic growth and development of a country is dependent on the growth of various sectors operating within the economy. One of the most important sectors in this perspective is manufacturing sector, whose growth and investment is linked with the overall economic growth. So, by keeping in view these important linkages, it is important to focus on the factors that affect the business growth in an economy.

Investment and growth of firms in an economy are of vital importance. Pioneer works in this regard were conducted by Bernanke (1998), Bond and Meghir (1994), Fazzari, Hubbard, Glenn and Petersen (1998). They investigated the investment behavior of firms for the empirical evidence of credit constraint and developed the dynamic equilibrium model which incorporates credit market frictions in the business cycle fluctuations. Their works broaden the depth and diversity of work in this meadow. Asymmetric information causes agency cost¹ due to which investment of the firms is hampered (Stein, 2003) and firms have to rely on internally generated funds for financing available investment opportunities.

Recent literature shows a lot of hindering factors in the growth path of businesses in an economy. Firms themselves report a lot of hurdles in their growth path but all these reported factors are not equally constraining the growth of the firms. Some of these factors directly hold back the growth and some indirectly create hindrance in firms' growth path. Most important hindering factors for firms' growth are related to finance, crime and political instability (Ayyagari, Demircuc-Kunt, & Maksimovic, 2008).

The theory which points out positive relation between financial growth and economic development (Schumpeter, 1911) was verified by a lot of researcher's up till now. This phenomenon

also works at the micro level where firms need finance to grow either by generating it internally or by going for external sources of finance by considering the financial policy of the firm. Firms finance their investment projects by using various sources of finance. These sources include debt, equity and cash flow.

In other words, firms finance their investment opportunities either by using external finance or by internally generated funds. The provision of finance from the external sources (banks and capital market) depend on firms' characteristics' i.e. financial performance, risk involved and asset base of firms because of the risk averse nature of financial institutions. Access to external finance and its cost is an important hindering constraint for the growth of firms.² Financial market in Pakistan is not perfect; because of this finance is a major hurdle in the growth of firms in Pakistan (Ahmed & Naveed, 2011). Size and other characteristics were also found to be important determinants for the financial access in Pakistan.³

Literature in case of Pakistan focuses on the capital structure of firms by using five to ten years of the data and tries to find out the optimal capital structure for the firms or attempt is made by dividing firms into constraint and non-constraint on the basis of cash flow volatility.⁴ Some of the work is done by incorporating the size and age in the investment model to access their impact on investment behavior. Literature on growth of firms in the context of credit constraint is not explored much.⁵ This study tries to fill this gap in case of Pakistan by using firm level data of publicly listed firms in the manufacturing sector ranging from 1974 -2010.

First of all, models for the full sample of firms for the period from 1974 to 2010 are estimated.⁶ Secondly, the sample is further divided in to the 1974-1990 and 1991-2010 periods that help to analyze the degree of credit constraint in pre financial sector reform and post financial sector reform period respectively.⁷ Thirdly, sample is divided into textile cotton, textile synthetic, sugar, chemical, engineering and cement industries for analyzing the impact of credit constraint growth in different industries.

Lastly, this study divides the firms into three classes; low, medium and large on the basis of total assets, debt to equity ratio and dividend to equity ratio to access the sensitivity of credit constraint.

2. Literature Review

2.1. Credit Constraint and Firms' Growth

Financial constraints have different impact on the growth of firms belonging to different groups. This division is done on the basis of different characteristics of the firms. This section explains the literature in context of credit constraint and growth of firms. By classifying the firms into small and large on the basis of employees, Becchetti and Trovato (2002) estimate a sample of small Italian firms having employees between 5-10. Their results show that small and younger firms have the potential to grow and if they are financed by the external finance or having easy access to the external finance they can grow more rapidly. But the hurdle to their growth is the lack of access to external finance.

Subsidies provided by the state to firms have a positive impact on the growth of firms and these firms grow faster as compared to those which are not under the umbrella of subsidies (Becchetti & Trovato, 2002; Hyytinen & Toivanen, 2005). Becchetti and Trovato (2002) by estimating the firm level data from Finland finds the impact of public policy on growth and innovation of the firms. Financial constraints have strong adverse effect on the growth and innovation of firms (Hyytinen & Toivanen, 2005). Innovation is also correlated to the growth of the firms i.e. if the firms have made innovation in the production technology then the firms grow more rapidly. One of their most important finding is that of the impact of the public policy on the growth and innovation of the firms. Government funding to the firms which rely on the external finance improves firms' growth and innovation activities (Hyytinen & Toivanen, 2005).

Beck, Demirguc, and Maksimovic (2005) by using a survey based firm level dataset from 54 countries report the major

constraints which the firms face in their path of growth. Credit constraint is one of the important hurdles in growth of small and medium sized firms (Beck et al., 2005). It is very interesting to see that in spite of the not proper functioning of the financial system in China its economy is growing faster. Because firms in China are highly profitable, that's why they are able to finance their investment through the retained earnings, so the internal finance push their growth to move forward (Guariglia, Liu, & Song, 2008). Ownership characteristics of the firms also have an impact on the intensity of credit constraint to the growth of firms i.e. foreign firms are not much credit constraint as compared to that of the domestically private owned firms.

Growth of the state owned firms is not constraint by the internal finance because state owned firms despite of the profit have different other political and welfare motives because of this they can easily get finance from the financial institutions whereas growth of the privately owned firms is affected by the internal finance (Guariglia et al., 2008).

Growth of the privately owned firms is stunning and it is surrogated by internal finance while state owned firms have to response to the economic and political objectives due to which they are less dependent on the internal finance (Bai, Lu, & Tao, 2005). On the other hand, privately owned firms don't have too much access to that of the external finance because of many hurdles to their path like collateral, taxation and the most important is asymmetric information problem. Banks consider them risky as compared to that of the state owned enterprises (Guariglia et al., 2008; Héricourt & Poncet, 2009).

Impact of different sources of finance on the growth of the Spanish manufacturing firms indicates that small and new firms have low growth rates when they enter in the business. Because of their less access to the external finance, they heavily relay on the cash flow and short term debts. Therefore, they are more sensitive to that of the cash flow and short term debts while on the other hand firms which are old and have high growth rates are more

sensitive to that of the long term debt (Guariglia et al., 2008; Segarra & Teruel, 2009).

External finance is of vital importance for firms' growth because firm uses some of its portions in research and development activities which have positive effect on the growth of the firms. It is also witnessed that with the increase in firm size and age, their access to the external finance also increases (Moreno-Badia & Sloodmaekers, 2009). Access to external finance has a positive effect on the growth of the firms (Musso & Schiavo, 2008). Musso and Schiavo (2008), estimated panel data on French manufacturing firms for the period of 1996-2004. Their findings show that, because of financing constraints, newly entered firms face difficulties in accessing the external finance due to which probability of leaving the market increases. Financial constraint is positively correlated to that of the productivity of the firms in the short-run (Musso & Schiavo, 2008).

In survey of over 6,000 firms in 1992, Binks and Ennew (1996) found that lack of access to finance is one of the major hurdles in path of the firms' growth and one of the important causes of this problem is the asymmetric information whose roots are in the imperfect capital markets. Banks and other financial institutions do not have complete or perfect information about the firms due to which problems of asymmetric information arises. Younger firms which have much potential to grow face hard credit rationing while this can be eliminated by developing linkages with financial institutions and markets (Binks & Ennew, 1996). In short, younger and less profitable firms are more credit constraint as compared to that of their counterpart. Due to the imperfect capital market in the developing countries smaller firms are much more credit constrained as compared to their bigger and older counterparts. The firm's growth is affected by the credit constrained; smaller firms are more affected as compared to the bigger firms (Oliveira & Fortunato, 2006).

The impact of credit constraint on the growth of firms is different in transitional economies as compared to that of the developed economies. Hutchinson and Xavier (2006) compared the transitional with well-established economy and catch the impact of financial constraints on the growth of firms in transitional economy (Slovenia) and the established economy (Belgium). The firms in the transition economy like Slovenia are more credit constraint and the growth of the firms in this economy is much more affected as compared to that of the firms in the established market. So the growth of smaller firms in Slovenia rely on the internal cash. Overall findings of the literature show that most affected firms from the financial constraints are medium and small sized firms. This issue mostly occurs in the economies where the capital markets are not developed. Growth behavior of the firms is also found to be effected by the abrupt polices' shift in the economy (Hutchinson & Xavier, 2006).

2.2. Credit Constraint: An Impediment to Growth

Carpenter and Petersen (2002) presented the internal finance theory of growth to show the bred effect of financial constraint on the firms' growth. As in previous literature, only effects on investment was explored i.e. the work of S. M. Fazzari, Hubbard, and Petersen (2000). The main contribution of S. M. Fazzari et al. (2000) work is introducing the liquidity into the regression to catch the impact of credit constraint on firms' growth.

The major and widely discussed impediment to the growth of firms in the developing countries is credit. In the developing countries firms have lack of access to external finance especially smaller and younger firms (Ahmed & Naveed, 2011) along with that the availability and cost of finance is also a hurdle which is important to put firms on the track of growth (Binks & Ennew, 1996). Carpenter and Petersen (2002) put a milestone in this era by estimating a panel of 1600 small manufacturing UK firms and they find that the growth of the small firms in the UK are credit constrained. In other words we can say that the growth of the smaller firms in the UK is much more dependent on the internal finance. Foreign firms are not credit constraint because of their

easy access to the external market as compared to domestically owned firms because domestically owned local firms are usually small. Therefore, foreign firms are not much relying on the internal finance for their growth they will go for the external financial market for financing the potential investment opportunities are available to them (Hutchinson & Xavier, 2006).

Firms' growth has much importance not only for the individual owners of the firms but also if one will look at them as a whole in the economy because the aggregate growth of all these firms in the economy is correlated with the overall growth of the economy. From that prospective it is important for the researchers and policymakers to have a look on the growth dynamics of the firms especially to identify the main hindrance to the growth of the firms.

2.3. Credit Constraint and Firms' Growth: Theoretical Model

This section provides the theoretical framework and analytical model for the empirical investigation of credit constraint and firms' growth. In order to develop the theoretical linkages of the model with these empirical equations, study follows the base work of Carpenter & Petersen (2002).

2.3.1. Frictions in Financial Market

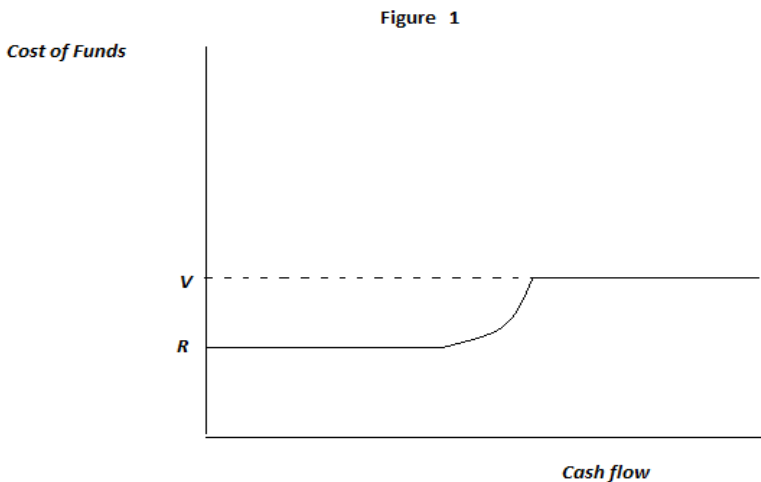
Credit rationing in a simple way can be defined as the credit constraints or the limitations in the supply of credit from the lenders side. Most of the literature available on credit rationing is focused on the incomplete or asymmetric information between debtor and lender. For example, a company is going to start a project and that particular company is aware of complete return and risk on the project. If company needs finance for availing this particular project, first option is to finance it through internally generated funds and if investment is huge and company doesn't have enough funds then management will go for an external source of finance.

Before financing, banks compute the risk of investment for the whole group of firms i.e. risk of the industry to which the firms belongs. Usually banks are not completely aware of the real risk of the project for which the company is demanding finance because of incomplete information. Financial institutions are risk averse in nature so they want return which is slightly higher than the return on the internal finance (cash flow) of the firm. If net returns of firms increases then the repayment probability⁸ of debt also increases. If for instance, banks increase its interest charges then the returns of the banks might increase while the cost of the firms on particular project decreases due to which probability of loan return decreases because firms have to pay more interest due to the increase in interest expense. Manager tries to go for the riskier projects⁹ to get more returns to compensate the high interest expenses from the banks. This causes moral hazard problem because of less or incomplete information. So, there exists some sort of incomplete information between the lenders and borrower due to which a chock is created between the cost of internal finance and external finance. This chock is financial expense which the firms bear for availing the profitable investment opportunities.

2.3.2. Firms' Growth and Internal Finance

There is a lot of work on financing constraints and their impact on the real activity of firms. The central focal of whole literature is the imperfections in the capital market. Because of imperfection in the capital market there is a chock between internal and external finance as we explained above in the theory of credit rationing. Literature suggests that this chock is due to the asymmetric information and because of this asymmetric information moral hazard and adverse selection problem occurs. Broader use of debt finance is not earmark for firms having little collateral or small firms. So, these firms are more exposed to that of the asymmetric information problem whereas larger firms have soft corner to get loans from the financial institutions because of their large asset base. The physical asset appears to be signals from firms to financial institutions for getting loans.

A lot of literature shows that financing constraints have a greater impact on the investment and growth behavior of small firms. The following figure 1 helps us to explain the main idea behind the financial hierarchy and this is then related to the asset expansion for developing dynamic equilibrium growth model for empirical investigation.



The horizontal axis in the Figure 1 shows the cash flow while the vertical axis shows the cost of funds. The points V and R on the vertical axis show sources of finance. R shows cost of internal funds which the firms bear for investing in the available investment opportunities whereas V shows the cost of equity when all the internal finance are exhausted. The supply of the finance schedule shows a standard hierarchy of financing consisting of three regions (Fazzari et al., 1988; Kuh, 1963). The horizontal line in Figure 1 shows that the supply curve of finance is constant up to the availability of internal finance (cash flow). Then there is an upward shift to the supply curve this upward cut off shows that when all the internally generated finance is eliminated then for the expansion of firms, the manager will go for the debt finance which is more costly than internally generated finance if capital market is

imperfect. So, if the firm goes for debt finance the cost of financing increases which is clearly seen from the upward shift of the finance supply curve. There are several reasons for this upward shift in the supply curve. Main reason of this increase in cost is (a) asymmetric information (b) financial distress and (c) collateral limits on the firms. The marginal cost of using debt is increasing because of the increasing financial distress with the increasing use of debt finance. This increasing use of debt finance increases the riskiness of the firms. Because of the increase in the financial distress banks demand more return on their provided debt. Due to this, marginal cost of debt increases with the use of the extra unit of debt finance. The next best alternative source of finance for firms is to issue new shares if potential investment opportunities are available. This is depicted in figure 1 the supply schedule of finance by reaching up to certain extent becomes horizontal which is showing the constant availability and cost on the externally generated funds by issuing new shares. Because of this shift, a chock between the cost of Internal and External Finance (V-R) is created which is shown in the Figure 1.

Now consider the following figure 2 which explains the demand behavior of firms in the market. This is reflected through expansion of firms. Marginal revenue expansion here after MRP (expansion)¹⁰ shows the return on the optimally utilized assets and input used by the firms for production. When revenue increases, it indicates that the firms are expanding and the return on the assets increases. MRP (exp) is composed of MPP which is marginal physical product of the firms which is then multiplied with the revenue of firms. The following figure 2 explains the expansion behavior of the small firms' horizontal axis shows the changes in assets. When the firms are expanding they will move along the MRP (exp) schedule while the vertical axis shows the MRP of the firms.

The horizontal axis in the figure 2 is the representation of the firms' asset growth. Now by combining figure 1 and figure 2 we obtained the following Figure 3 which is borrowed from the work of Carpenter and Petersen (2002) for a better understanding of the model.

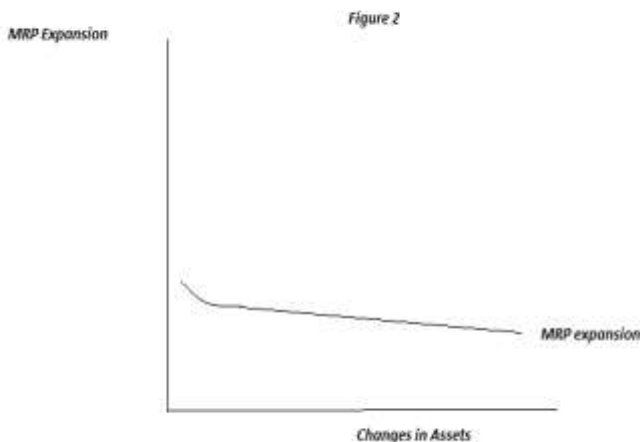
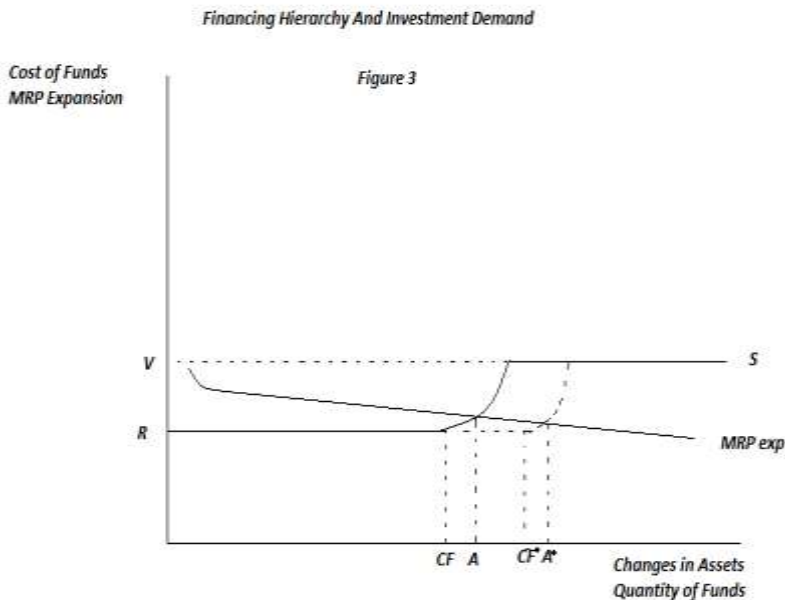


Figure 3 is a combination of both the above explained Figure 1 and Figure 2. In figure 3 the slight downward moving of the MRP (exp) is because of the competition which drives the return towards internal cost of funds.



Now look at figure 3 by considering the imperfect capital markets as shown by the vertical supply curve of the finance. This cuts the MRP schedule so at that point change in assets and cash flow becomes equal. This can be represented as follows,

$$A' - A = CF' - CF \quad (1)$$

This shows that the additional dollar increase in the internal finance will spawn the additional increase in the assets of the firms. Here this study considers that assets are composed up of total fixed assets i.e. plant and machinery of the firms which are not easily convertible in to liquid for production process. With the assumption of the imperfect financial markets this additional dollar increase in internal finance will cause approximately one unit increase in the asset expansion. It can be shown in following equation,

$$\Delta A' - \Delta A \approx \Delta CF' - \Delta CF \quad (2)$$

The leverage effect is also shown in the figure 3. With the increase in the asset growth because of the use of the internal finance the asset base of the firms increases. So the firms have more power of negotiating for getting the loans from the financial institutions to invest in the potential projects. This leverage effect is depicted in the figure 3 by the dotted line which shows shift in the supply schedule of finance.

Because of this leverage effect, with one unit increase in the internal finance there should be more than one percent increase in the asset growth. This effect can be captured as follow in equation,

$$\frac{\Delta A}{\Delta CF} \approx 1 \quad (3)$$

This should hold only if there exists one to one relationship between growth and internal finance of the firms because of leverage effect the equation 3 becomes,

$$\frac{\Delta A}{\Delta CF} \approx 1 + \lambda \quad (4)$$

λ in equation 4 shows the leverage effect. Growth can be defined as $Growth_{it} = \Delta A/A$ or we can calculate it by taking the log difference of assets. The equation, by following the work of Carpenter and Petersen (2002) used to estimate the results for impact of credit constraint on firms growth is given below.

$$Growth_{it} = Growth_{it-1} + \beta_1 \left[\frac{Sales_{it}}{K_{it-1}} \right] + \beta_2 \left[\frac{CF_{it}}{K_{it-1}} \right] + \gamma_i + \alpha_t + \varepsilon_{it} \quad (5)$$

$$Growth_{it} = Growth_{it-1} + \beta_1 Sales\ Growth_{it} + \beta_2 \left[\frac{CF_{it}}{K_{it-1}} \right] + \gamma_i + \alpha_t + \varepsilon_{it} \quad (6)$$

$Growth_{it}$ is the growth rate of asset of firm i at time t , γ_i represent the firm fixed effect and CF_{it}/K_{it-1} is the cash flow to capital ratio, α_t is the time specific effects and ε_{it} is the random disturbance term. Equation 5 and 6 are general forms of equation which are estimated here. The difference between the equation 5 and 6 is that of the proxy used to capture the investment opportunities of the firms. In equation 5 investment opportunities are captured through sales to capital ratio while in equation 6 investment opportunities are incorporated by including the variable of sales growth. Sales growth is calculated by taking the log of difference of the sales variable. Both of these variables are widely used in the literature to incorporate investment opportunities in the dynamic model.

3. Estimation Technique And Variables' Construction

3.1. Estimation Technique for Analysis

This study applies Generalized Method of Moments (hereafter GMM) one step and two step techniques for the estimation of dynamic investment and growth models. GMM one step and two step estimation technique are used to tackle the problem of

endogeneity which arises because of the inclusion of lag of dependent variables and individual effects. The major problem with the OLS as appeared in the literature is that the estimated coefficients are not efficient and consistent if the independent variables are assumed to be endogenous. So, to avoid these problems, this study estimates the models by using GMM one step and two step estimation technique. Brief description of estimation technique is explained below.

3.1.1. Panel Unit Root Test

The problem of unit root leads to the biased results. Problem of unit root may occur in the panel data because of large cross-sections and time periods. Before going for further analysis it is important to detect the existence of unit root in the data. There are various tests which are used to check the presence of a unit root in the panel data set.

The starting point of the panel unit root test is whether there are restrictions on the autoregressive process across the cross-section or series. Consider the following AR(1) equation for the panel

$$y_{it} = \rho_i y_{it-1} + X_{it} \delta_{it} + \varepsilon_{it} \quad (7)$$

$$i = 1, 2, 3, \dots, N$$

$$t = 1, 2, 3, \dots, T$$

whereas i represents the cross-sectional units that are observed over the time series t , X_{it} represents the independent variables in the model having fixed effect or the individual trends, while ε_{it} is the error term assumed to be normal and ρ_i represents the autoregressive coefficients. If $|\rho_i| < 1$ then y_{it} is assumed to be weakly stationary and if $|\rho_i| = 1$ then y_{it} contains a unit root.

There are many tests that are used to detect the unit root like Levin, Lin, and Chu (2002), Im, Pesaran, and Shin (2003), Maddala and Wu (1999) as the above explained tests differ in

setting the assumptions regarding autoregressive parameter ρ_i . Levin et al. (2002) assumed that $\rho_i = \rho$: implying those autoregressive parameters are common across all cross-sections while Im et al. (2003) assume that autoregressive parameters are heterogeneous across cross-sections.

This study only reports Levin et al. (2002) and Im et al. (2003) test. The results of the panel unit root test for the variables used in this study are reported in table 1.

3.1.2. J-Statistics

J-statistics or Sargan test or Hensen test is applied to check the validity of the instrumental variables used in the analysis. If there are more instruments than parameters then J statistics is used to test the validity of over identifying restrictions.

3.2. Variables' Construction

This section explains variables used for analysis. The data on variables used by this study is collected from "Financial Statement Analysis of the Joint Stock Companies" prepared by State Bank of Pakistan. This study analyzes 500 firms of manufacturing sector of Pakistan for the period from 1974-2010. Brief description, composition, calculation and standard accounting definition of the variables are given below.

3.2.1. Capital (K)

Capital includes property, plant, equipment and machinery. Capital is calculated as the expenditure on the fixed assets of the firms by deducting the depreciation. By deducting the depreciation from the fixed asset at cost we obtained the capital for the analysis. Depreciation shows wear and tear of the capital counted on annual basis.

$$\text{Capital (K)} = \text{Expenditure on fixed asset} - \text{Depreciation}$$

This is one of the important factors in determining the performance of firms. By using this in combination of other variables one can access the performance of the firm in different ways. Increase in the capital of firms indicates the increase in production capacity of firms.

3.2.2. Investment (I)

Investment is defined as the expenditure on the fixed assets. Fixed assets include plant, machinery and equipment. It is calculated by deducting the current year expenditure on fixed asset (K_{it}) from the previous year expenditure on fixed asset (K_{it-1}) and adding the depreciation. Depreciation shows wear and tear of the capital counted on annual basis. Following formula is used to calculate the investment.

$$I_{it} = K_{it} - K_{it-1} + D_{it}$$

Where I_{it} shows the investment, K_{it} is the current year fixed asset, K_{it-1} is the past year fixed asset and D_{it} is the depreciation. Investment is also an important indicator of measuring the performance and growth of companies. Higher the investment means higher the production capacity which will accelerate the profit of firms.

3.2.3. Cash Flow (CF)

It is used to explain the variability of the internal finance and as a proxy for the financial constraint of the firms. By including this variable in the regression analysis, the study adds liquidity into model to access the impact of credit constraint on firms' investment and growth. In this study, the sensitivity of cash flow to investment is given key importance. Calculation of cash flow is defined below:

$$CF = R + Depreciation$$

CF is the cash flow; R is the retention in business.

Retention in the business is obtained after deducting tax provision and dividends from the income. Cash flow is of vital importance for the firms. Higher cash flow indicates that high internal finance generated by firms which can be used as a source of investment for the potential investment opportunities. In the financing hierarchy, cash flow is the cheapest source available for the investment. Huge literature use cash flow for assessing that either the firms are financially constrained or not through investment-cash flow sensitivity.

3.2.4. Sales (S)

This variable is of significant importance for the firms. This shows revenue generated by the firms. The ultimate goal of the firms is to maximize the sales for their growth. The purpose to include this variable is to capture the demand side or the investment opportunities for the firms. The rationale behind this is that when sales of firms' increases in the market this gives a signal to the firms for higher expected future demand due to which the investment opportunities for the firms increases. For the sake of profit firms want to invest more to capture the demand from the market. This variable is used in place of Tobin's Q to capture the investment opportunities for the firms. A lot of studies used this variable and explored it to be an important determinant of firms' growth and investment.

3.2.5. Growth

Growth is calculated by the taking difference of investment on the physical assets like plant and machinery in logarithm form. In order to calculate the growth, this study firstly calculate investment in fixed assets and takes the difference of current and previous year investment on fixed asset in logarithm form. The following formula is used to calculate the growth.

$$Growth_{it} = \text{Log}(I_{it} - I_{it-1})$$

I_{it} shows the investment on fixed asset in current year and I_{it-1} is the investment on fixed asset in the previous year. This variable is of vital importance because it directly indicates the performance of firms either they are growing or not. In most of the studies, growth is used as dependent variable for analyzing the factors that affect growth of the firms. Carpenter and Peterson (2002) used this variable in combination of internal finance to access either the growth of small firms is constrained by internal finance or not.

3.3. Variables for Classification

The following explained variables are not used in the regression analysis but study uses these variables for the division of the firms into groups of small medium and large to access the variation in investment cash flow sensitivity and growth cash flow sensitivity across different groups on the bases of flowing explained variables.

3.3.1. Dividend to Equity

Dividend to Equity is calculated by dividing the total dividend to the shareholder's equity (Ordinary Share Capital + Surplus). Following formula is used to calculate this.

$$\text{Dividend to Equity} = \left(\frac{\text{Dividend}}{\text{Share Holders Equity}} \right)$$

Study by using dividend to equity ratio divides firms into three classes; low dividend paying, moderate dividend paying and high dividend paying firms. Low dividend to equity ratio indicates that firms are paying low dividends as percentage of equity whereas high dividend to equity ratio indicates that firms are paying high dividends as percentage of equity.

3.3.2. Debt to Equity

Debt to equity is a measure of companies' financial leverage. This ratio is obtained by dividing the firms' liabilities with that of the

shareholder equity¹¹. By dividing the firms into different classes helps us to explain how the sensitivity of the relation between investment to cash flow and growth to cash flow varies if the firms have more, less and moderate debt to equity ratio. Higher debt to equity ratio shows the aggressive behavior of the firms in financing their investment with the debt whereas low debt to equity ratio indicates less aggressive behavior of firms towards using debt. Following formula is used to calculate

$$\text{Debt to Equity Ratio} = \frac{(\text{Current Liabilities} + \text{Non Current Liabilities})}{(\text{Share Holders Equity})}$$

3.3.3. Total Assets

This is used to divide the firms into small, medium and large size firms. Total asset is obtained by adding current assets¹² and noncurrent assets¹³. A lot of studies use this variable to divide firms into small, medium and large size to access the prospect that either investment and growth of firms is homogenous across these different size groups or not.

$$\text{Total Asset} = \text{Current Asset} + \text{Non Current Asset}$$

4. Results and Discussion

Manufacturing sector in Pakistan is of vital importance because of its significant contribution in Gross Domestic Product (hereafter GDP). Manufacturing sector works as a catalyst in fostering the economic growth and development. As per 2012-2013 figures, manufacturing sector contributes 13.2% in the GDP of Pakistan and 13.8% of the total labor force is working in this sector. Both of these economic indicators well explains the importance of the manufacturing the sector in Pakistan's economy. The results estimated from the sample of 500 firms of the manufacturing sector of Pakistan for the period of 1974 - 2010 are explained below.

4.1. Credit Constraint and Firms' Growth

This section explains the results of credit constraint and growth for the full sample in case of manufacturing sector of Pakistan. Similarly, for analyzing the impact of credit constraint on firms' growth, this study, by following the literature estimates two equations 5 and 6. The main difference between the equations 5 and 6 lies in their method to incorporate the investment opportunities. In equation 6 sales growth is used to capture the investment opportunities while in equation 5 sales to capital ratio is used for this purpose.

First both equations for the full sample from 1974 - 2010 are estimated. The results obtained from the estimation are reported in Table 2. Results obtained from estimating both the equations 5 and 6 point that firms in manufacturing sector of Pakistan are not credit constraint. In other words, their growth is not constraint by the internal finance. The results of the equation 5 demonstrate that the effect of sales to capital ratio is negative indicating decline in the marginal productivity of capital. It is discovered that with 1% increase in the marginal productivity of capital there is 0.031% decline in the growth of the firms. Effect of sales growth is positive and significant that specifies the investment opportunities for the firms of manufacturing sector. The effect of sales growth indicates that 1% increase in the sales growth causes 0.59% increase in the growth of physical asset of the firms.

The effect of cash flow in case of equations 5 and 6 explored to be significant at 5% level. But the effect of cash flow for the equation 5 is negative whereas it is positive for the equation 6. In case of equation 6, results indicate that with the 1% increase in the internal finance, there is 0.26% increase in the growth of the physical assets of the firms whereas results for the equation 5 points out that with the 1% increase in the internal finance there is 0.22% decline in the growth of the physical asset of the firms.

Table 1: Panel unit Root Test

Variables	LLC Test Stat	P- value	IPS Test Stat	P- value	Conclusion
$\frac{S_{it}}{K_{it-1}}$	-13.29	0.000	-9.88	0.000	Stationary
$\frac{I_{it}}{K_{it-1}}$	-484.99	0.000	-36.80	0.000	Stationary
$\frac{CF_{it}}{K_{it-1}}$	-17.11	0.000	-22.92	0.000	Stationary
$Sales\ Growth_{it}$	-46.21	0.000	-52.52	0.000	Stationary
$Growth_{it}$	-220.92	0.000	-64.22	0.000	Stationary

Note

- LLC denotes the Levin, Lin and Chu panel unit root test while IPS is the Im, Pesaran and Shin panel unit root test.
- $(S_{it}/K_{it-1}), (I_{it}/K_{it-1}), (CF_{it}/K_{it-1})$ are Sales to capital ratio, investment to capital ratio, cash flow to capital ratio, sales growth and Growth in the investment of fixed assets.

The effect of the cash flow is lesser than one for both equations that in accordance to the hypothesis indicates that firms' growth is not constrained by internal finance. Lag of dependent variable in both equations is significant at 5% level of significance having a negative sign that indicates the convergence behavior of the firms¹⁴.

Instruments validity is tested by using the Sargan test. The results of Sargan test indicates that the instruments used in both equations are valid. Second order serial correlations among the residuals are represented by the m2 for both the equations. The null of no serial correlation for both equations is accepted by this study. This indicates that results for both equations do not encounter with the problem of serial correlation among residuals.

4.2. Empirical Investigation of Impact of Financial Reforms on Credit Constraint and Firms' Growth

This section explains the results for impact of financial sector reform on credit constraint and growth for this equation 6 is estimated and results obtained are reported below in the table

Table 2: Credit Constraint and Growth (1974-2010): Dependent Variable $Growth_{it}$

Model Using Sale to Capital Ratio for Investment Opportunities		Model Using Sales Growth for Investment Opportunities	
Explanatory Variables	Coefficients	Explanatory Variables	Coefficients
$Growth_{it-1}$	-0.4255* (0.0013)	$Growth_{it-1}$	-0.3343* (0.0025)
$\frac{S_{it}}{K_{it-1}}$	-0.0318* (-0.0062)	$\frac{CF_{it}}{K_{it-1}}$	0.2658* (0.1161)
$\frac{CF_{it}}{K_{it-1}}$	-0.2294* (0.0624)	$Sales\ Growth_{it}$	0.5982* (0.0729)
$m2\ (Statistics\ Value)$	0.1466	$m2\ (Statistics\ Value)$	0.3444
$Sargan\ (p\ value)$	0.1444	$Sargan\ (p\ value)$	0.1131

Note

- $Growth_{it-1}$ is the Growth of physical asset, it the lag of the dependent variable, (S_{it}/K_{it-1}) is Sales to Capital ratio and (CF_{it}/K_{it-1}) cash flow to capital ratio. Constant and Time dummies are included. (Not reported). Standard errors are in parenthesis.
- $m2$ is the second order serial correlation tests based on residuals asymptotically distributed as $N(0,1)$ under the null of no serial correlation.
- Sargan is the test of instruments' validity asymptotically distributed as χ^2 under the null that instrument is valid.
- Statistics significant at 1% is denoted by *.

The effect of cash flow to capital ratio is positive, significant and greater than one at 1% level of significance. In pre financial sector reform era, results show 1% increase in internal finance causes 1.26% increase in the firms' fixed assets' growth.

Results for the pre financial sector reform era indicates that with 1% increase in internal finance firms grow at a rate more than 1% because of the leverage effect. The effect of sales growth for pre financial sector reform era is significant and negative at 1% level of significance. It indicates that the firms' investment is insensitive to the sales during this time frame. The lag of dependent variable is found to be negative and significant at 1% level of significance. It is an indication of convergence of the firms.

The effect of cash flow for the post financial sector reform era discovered to be positive and significant. Result shows that 1% increase in the internal finance causes 0.63% increase in the growth of firms' fixed assets that in light of hypothesis indicates that firms' growth is not constrained by internal finance in post financial sector reform era. Highly positive and significant effect of sales growth at 1% level of significance is indication of high investment opportunities in the post financial sector reform era.

The overall results indicate that the growth of firms in the manufacturing sector of Pakistan is constrained by internal finance in pre financial reform era while it is not constrained by internal finance in post financial sector reform period. This is because of privatization, there is a monopoly break down in financial market and credit is dispersed widely and deeply because of the injected competition through the privatization of the financial institutions. Due to this, firms do not face financial constraints in post financial sector reform.

4.3. Credit Constrained and Firms' Growth: Homogeneity across Different Groups

In this section results for the prospect that either credit constrained and growth of the firms varies across different groups or not are explained. For this purpose, firstly firms are divided into groups of small, medium and large, on the basis of total assets. Secondly, firms are classified into three classes on the basis of low debt to equity ratio, moderate debt to equity ratio and high debt to equity ratio. Lastly, firms are divided into three groups of low dividend to equity ratio, moderate dividend to equity ratio and high dividend to

equity ratio. These variables are used in the literature in order to analyze that in which particular group the sensitivity of internal finance to investment and growth is different from others.

Table 3: Financial Sector Reforms, Credit Constraint and Growth

Explanatory Variables	Coefficients for Pre and Post Financial Reform	
	1974-1990	1991-2010
$Growth_{it-1}$	-0.1895* (0.0242)	-0.3076* (0.0074)
$SalesGrowth_{it}$	-0.3086* (0.0817)	0.2085* (0.0242)
CF_{it}	1.2635* (0.2826)	0.6347* (0.0685)
K_{it-1}		
$m2$ (Statistics Value)	0.3491	0.1724
$Sargan$ (p value)	0.4371	0.7029

Note

- 1974 to 1990 period is Pre Financial Reform era and 1991 to 2010 is Post Financial Reform era
- Constant and Time dummies are included. (Not reported).
- GMM two step estimates.
- Statistics significant at 1% is denoted by *.

Kashyap, Stein, and Wilcox (1995) divided the firms in low and high dividend firms according to dividend to equity ratio and analyze the response of low and high dividend paying firms. Fazzari et al. (1988) also divide the firms according to dividend to income and total assets into small, medium and large firms. Similarly, Hsiao and Tahmiscioglu (1997) divide the firms into small medium and large on the base of dividend payout ratio while Terra (2003) analyzed the sensitivity to internal finance by dividing the firms into small, large, domestic and multinational categories.

This section is further divided in to three sub sections. First section explains the results of credit constrained and growth by dividing the firms into groups of small, medium and large according to total assets while second section explains the results

for the credit constrained and growth by dividing the firms into low dividend to equity ratio, moderate dividend to equity ratio and high dividend to equity ratio and lastly the results by dividing the firms on the basis of debt to equity ratio are explained for the period of 1974-2010.

4.4. Growth and Credit Constrained In Different Size Firms

In this section results for the prospect that credit constrained and growth of the firms varies across different groups on the base of their size are explained. Study estimates equation 6 for the small, medium and large size firms and their results are reported below in the Table 4.

Result for the small Size firms show that the effect of cash flow is positive and significant at 1% level of significance. Result shows that 1% increase in the cash flow to capital ratio causes 1.97% increase in the growth of the physical assets of the firms which in the light of hypothesis shows that growth of small firms is constrained by internal finance.

The effect of sales growth for the small firms is positive and significant indicates that it causes 0.26% increase in the growth of the physical assets of the firms. This is an indication of investment opportunities of firms having small asset base or small in size. The lag of the dependent variable is negative and significant in all three groups which is an indication of adjustment cost bear by the firms. Results for the medium size firms are also reported in the Table 4.

Table 4: Firm Size and Growth (1974-2010): Dependent Variable $Growth_{it}$

Division on the Bases of Total Assets			
Explanatory Variables	Small Size Firms	Medium Size Firms	Large Size Firms
$Growth_{it-1}$	-0.3170* (0.0010)	-0.3335* (0.0005)	-0.4110* (0.0020)
$Sales\ Growth_{it}$	0.2615* (0.0922)	0.1956* (0.0242)	0.7099* (0.0945)
CF_{it}	1.9734* (0.1401)	0.3094* (0.0235)	-0.0468* (0.0327)
K_{it-1}			
$m2$ (Statistics Value)	0.3592	0.0971	0.2332
Sargan (p value)	0.3008	0.5069	0.1860

Note

- Constant and Time dummies are included. (Not reported).
- GMM two step estimates.
- Statistics significant at 1% is denoted by *.

Result for the medium size firms shows that the effect of cash flow is positive and significant. With the 1% increase in the internal finance, there is 0.30% increase in the growth of investment of the firms, which in light of hypothesis indicates that growth of medium size firms is not constrained by internal finance. The effect of sales growth for the firms in this group is positive and significant that is an indication of the investment opportunities for the firms in this group.

Similarly, results obtain for large size firms indicate negative and significant relation between the internal finance and investment growth of the large size firms that is an indication of non-reliance of large firms on their internal finance. This shows that growth of large size firms is not constrained by internal finance. This is due to the easier availability of external finance in case of large firms as compared to small and medium size firms. The effect of sales growth is positive and significant, indicating the presence of investment opportunities for large size firms.

To summarize, results obtained clearly show that growth of the small firms is constrained by internal finance because of low collateral value of firms in this group. While the impact of credit constrained decreases as the asset size of firms increases that is clearly shown from the results reported above. The large and medium size firms are not found to be constrained by internal finance. It is because that large and medium size firms have high collateral value. So they do not have any such constrain for getting external finance. These obtained results are similar to the findings of Carpenter and Petersen (2002).

4.5. Leverage and Credit Constrained Across Different Groups

This section of study explains the results by dividing the firms into groups of less aggressive firms, moderately aggressive and highly aggressive firms in financing their investment and growth with debt. This division is done according to debt to equity ratio. The higher ratio indicates that firms are aggressive in financing their investment and growth with debt.

4.6. Debt Financing, Growth and Credit Constraint

This section explains the result for firms' growth, credit constrained and debt financing by dividing the firms into groups of less aggressive firms, moderately aggressive and highly aggressive firms in financing their growth with debt.

Division on the basis of debt to equity into less aggressive firms, moderately aggressive and highly aggressive firms in financing with debt helps to explain that to which extent the growth of firms is constrained by internal finance in all three different classes. The high debt to equity ratio indicates high use of debt by the firms for their potential projects similarly low debt to equity of the firms indicates that firms are less dependent on the debt financing.

Table 5: Debt Financing and Growth (1974-2010): Dependent Variable $Growth_{it}$

Division on the Bases of Debt to Equity			
Explanatory Variables	Less Aggressive Firms	Moderately Aggressive Firms	Highly Aggressive Firms
$Growth_{it-1}$	-0.3064 (0.0009)*	-0.3273 (0.0028)*	-0.4377 (0.0019)*
$Sales\ Growth_{it}$	0.4289 (0.0750)*	0.1375 (0.0724)***	1.4137 (0.0847)*
$\frac{CF_{it}}{K_{it-1}}$	1.5289 (0.1240)*	0.3754 (0.1273)*	0.1355 (0.0408)*
$m2\ (Statistics\ Value)$	0.3736	0.0932	0.7368
$Sargan\ (p\ value)$	0.3581	0.5183	0.0583

Note

- Constant and Time dummies are included. (Not reported).
- GMM two step estimates.
- Statistics significant at 1%, 5% and 10% is denoted by *, ** and *** respectively in the parenthesis in bold and italic style.

The effect of cash flow to capital for less aggressive firms is positive and significant at 1% level of significance. Result shows that with the 1% increase in cash flow to capital ratio there is 1.52% increase in growth of fixed asset of the firms that in accordance to the hypothesis is indication of the financially constrained firms. These are small firms who don't have enough collateral value to get external finance that's why their growth is explored to be credit constrained. The effect of sales growth is positive and significant, shows that 1% increase in the sales growth causes 0.42% increase in the growth of firms that is an indication of investment opportunities for the firms in this group. Whereas moderately aggressive firms (having medium debt to equity ratio) show that the effect of cash flow to capital ratio is positive and significant at 1% level of significance. Result shows that with the 1% increase in internal finance there is 0.37% increase in the growth of firms, which in light of hypothesis indicates that growth of moderately aggressive firms in financing with debt is not

constrained by internal finance. The effect of sales growth for the firms in this group is also positive and significant indicating the presence of investment opportunities for the firms in this group.

The results for highly aggressive firms (having high debt to equity ratio) indicate that with the 1% increase in the coefficient of cash flow there is 0.135% increase in the growth of the firms. In light of hypothesis indicates that growth of highly aggressive firms in financing with debt is not constrained by the internal finance. The effect of sales growth is positively significant and highly sensitive as compared to their counter parts which indicate high investment opportunities for highly aggressive firms in financing with debt. These are large firms who do not have the limitation on their collateral value for obtaining loans from the financial market. That's why they are not credit constrained and can easily get the loans to invest in potential investment opportunities.

The overall results for this classification indicate that growth of the firms who are less aggressive in debt financing explored to be constrained by internal finance whereas growth of moderately and highly aggressive firms in debt financing is not found to be constrained by internal finance.

4.7. Credit Constrained and Growth: A Comparison on the Base of Dividend to Equity Ratio

This section of study explains the results obtained by dividing the firms into three groups on the basis of dividend to equity ratio. Dividend to equity ratio explains how much dividends are paid out as a percentage of equity. Three groups in which firms are divided on the basis of dividend to equity are less dividend paying firms, moderate dividend paying and high dividend paying firms as percentage of their equity. Less dividend paying firms are the firms who are paying fewer dividends as a percentage of equity as compared to moderately and high dividend paying firms.

4.8. Firms’ Growth and Credit Constrained: Dividend to Equity Ratio

By following the above explained pattern, the firms are divided into less dividend paying, moderate dividend paying and high dividend paying firms on the base of dividend to equity ratio and result for credit constrained and growth are explained.

The effect of cash flow to capital ratio for less dividend paying firms found to be positive and significant at 1% level of significance and it shows that 1% increase in the internal finance causes 2.75% increase in the growth of firms. In light of hypothesis this relation indicates that growth of less dividend paying firms is constrained by internal finance. The effect of sales growth is positive and significant indicating investment opportunities for less dividend paying firms as percentage of their equity.

Table 6: Growth and Dividend to Equity Ratio (1974-2010): Dependent Variable $Growth_{it}$

Division on the Bases of Dividend to Equity			
Explanatory Variables	Less Dividend Paying Firms	Moderate Dividend Paying Firms	High Dividend Paying Firms
$Growth_{it-1}$	-0.3360* (0.0013)	-0.5007* (0.0007)	-0.4321* (0.0011)
$Sales\ Growth_{it}$	0.1637** (0.0766)	-0.1501*** (0.0707)	1.4810 (0.0657)
$\frac{CF_{it}}{K_{it-1}}$	2.7572* (0.1069)	0.2295** (0.0548)	0.1716* (0.0466)
$m2\ (Statistics\ Value)$	0.4462	1.0335	0.7030
$Sargan\ (p\ value)$	0.2279	0.1560	0.1380

Note

- Constant and Time dummies are included. (Not reported).
- GMM two step estimates. Statistics significant at 1% and 5% is denoted by * and ** respectively in the parenthesis in bold and italic.

The effect of cash flow to capital ratio explored to be positive and significant at 1% level of significance for moderate and high dividend paying firms but the sensitivity of relation between internal finance and growth is lesser than one for both moderate and high dividend paying firms that indicates that growth of firms in both groups are not constrained by internal finance. The effect of cash flow to capital ratio for moderate dividend paying firms indicates that 1% increase in cash flow coefficient causes 0.22% increase in the growth. Similarly, the effect of cash flow to capital for high dividend paying firms show that 1% increase in the cash flow to capital causes 0.17% increase in investment growth firms.

The overall result for all three groups indicates that the growth of low dividend paying firms explored to be constrained by internal finance because of this they are highly dependent on internal finance. These are the firms who are small in size and small firms' operational activities for generating profits are not financed by external financial sources because of the limitation in accessing the external finance. Due to this reason, they have to pay low dividends for the aim of utilizing these resources in profit generating activities (Fazzari et al., 1988). Whereas the growth of moderate and high dividend paying firms are not constrained by internal finance because of this there is no one to one relationship between internal finance and growth of firms for moderate and high dividend paying firms.

5. Summary and Conclusions

This study explored the impact of credit constraint on firms' growth by using firm level data of manufacturing sector of Pakistan for the period of 1974-2010. Generalized Method of Moments (1991) one step and two step estimation techniques are used due to the problem of endogeneity.

Sales to capital ratio and sales growth are used to capture the investment opportunities while cash flow is used as a proxy for internal finance. All these variables are constructed from more than

12,000 financial statements of the manufacturing sector of Pakistan.

Firstly, this study estimated the dynamic growth model for the whole manufacturing sector. Secondly, this study analyzes the data on the base of financial sector reforms in the history of Pakistan. Thirdly, this study divides the data industry-wise for industrial analysis. Lastly, growth model is estimated by dividing the firms into three different classes on the basis of total assets, debt to equity ratio and dividend to equity ratio.

Result of full sample shows that the firms in manufacturing sector for the period from 1974-2010 are not facing external financial constraints because of this effect of cash flow for the full sample found to be insignificant indicating that investment and growth of firms is not driven by their internal finance.

This study also explores the impact of financial sector reforms on firms' growth. The effect of cash flow turned out to be positive and significant in pre and post financial reform period. However, the effect of cash flow explored to be positive and highly significant during nationalization era and its intensity decreases with the decentralization of financial institutions. This indicates that firms are facing tight external financial constraint in pre financial reform era (1974-1990) as compared to post financial reform era (1991-2010).

Result for the homogeneity of firms' growth across different classes having different characteristics like size, dividend and debt indicates that sensitivity of firms' investment and growth to internal finance varies across different groups. Results show that growth of firms having small assets is constrained by internal finance because of this effect of cash flow for firms having small assets are greater than one while firms having medium and large assets are not constrained by internal finance. Similarly, firms' growth that is less dependent on debt finance is constrained by internal finance because these are the firms who do not have enough collateral value to show the financial institutions for obtaining loans, so for their growth they have to rely on their

internal finance. The effect of cash flow for firms that are moderately and highly aggressive in financing with debt is not greater than one indicating that the growth of firms belonging to these groups is not constrained by internal finance. Similarly, growth of firms that are paying low dividends is constrained by internal finance whereas growth of firms that are paying high dividends is not constrained by the internal finance.

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Footnotes

¹For more detail see Stein (2003).

²For more detail see Binks and Ennew (1996).

³See Hamnna and Hamid (2011) for more detail.

⁴For more detail see Sehrish *et.al.* (2013).

⁵Hashmi (2011) concluded that firms of manufacturing sector of Pakistan are financially constraint. Firms face imperfect competition in product market and do not follow optimal investment path.

⁶See Hussain (2006) for detail regarding economic policies and their implications in different regimes. The period form 1974-1977 and 1978-1988 in Pakistan was Bhutto and Zia regime respectively. The period form 1989-1999 and 2000-2008b in Pakistan is termed as democratically regime and Musharaf era respectively.

⁷See Zaidi (2006) for detail about Pre and Post Financial Reforms.

⁸Repayment probability is the ability of firms to pay back the loans. This is linked with the net returns of the firms from the project. If the project earns positive returns than it make firms able to pay back the loans, which is demanded or taken from the financial institutions for availing the profitable investment opportunities.

⁹Higher the risk, higher the return.

¹⁰MRP (exp) it basically shows the expansion path of the firms. (Exp) stands for expansion.

¹¹ $Share\ Holder\ Equity = Ordinary\ Share\ Capital + Surplus$

¹²These include all the assets which are easily converted in liquid when needed.

¹³These are assets which include physical assets i.e. which are not easily converted in to liquid form.

¹⁴ For more detail see Carpenter Petersen (2002).

Energy Consumption and Economic Growth: Evidence from Developed and Emerging Markets

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Abstract

This research analyzed the effect of energy consumption on economic growth using neo-classical one-sector aggregate production function with panel data from Emerging Markets and Developed countries over the period 2000–2013. This study has applied dynamic panel method in the form of two-step panel Generalized Method of Moments (both difference and system) GMM. The findings of this research exposed that both gross fixed capital formation and energy consumption have significant and positive effect on economic growth in both Developed and Emerging Market countries. In addition, labour force has been found to influence positively on economic growth in the group of Developed Market countries. However, labour force established the significant as well as negative effect on economic growth in the Frontier Market countries. Since the findings revealed that all the sampled countries are energy dependent, therefore, their policy makers should continue to promote the development of energy infrastructure with the aim to gain higher economic growth by making effective energy policies. This can be achieved through the allocation of more resources to the development of new sources of energy and ensure sustainability of energy use.

Keywords: Energy Consumption, Economic Growth, Panel Data, System GMM

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1. Introduction

In current scenario, the outcome of energy consumption on economic growth is an important issue in the global economy. Lee (2013) pointed that countries across the globe succeeded in shaking free from a subsistence economy as a result of the services provided by modern energy. This is because of the sufficient energy supply stimulates almost all socio-economic activities; it particularly boosts industrial and commercial activities as well as enhances the delivery of basic social and infrastructural services (Wesseh, 2012). The ratio of per capita energy consumption is one of the primary indicator of economic development of the country however, the share of energy consumption varies as developed countries absorbing larger amount, the Emerging Markets countries are only consuming least of the world's energy pie (Pirlogea, 2012). For instance, per capita consumption of primary energy in the United States recorded as 330 *gigajoules* in 1995, more than six times as much used by Emerging Markets countries, which used less than 47 *gigajoules* that year, when both the commercial and traditional energies are included (Energy and the Challenge of Sustainability, 2000)

Despite a great number of studies that have dealt with energy consumption and economic growth in both theoretical and empirical evidences studies (M. N. Kahsai, 2012; Lee, 2013; Noor, 2010; Raheem, 2015; Saidi & Hammami, 2015), the studies have failed to reach a harmony about the nature of the long-run along with the causality direction. Among the explanations for the failure to reach a consensus are the methodologies used, proxy variables for economic growth, the period of study, and energy consumption and the countries included in the analyses. Therefore, the main objective of this study is to observe the effect of energy consumption on economic growth for the panel of developed and emerging markets.

The contributions of this study are twofold. First, application of Generalized Method of Moments estimator (GMM) Arellano & Bond (1991) and its extension to system GMM for heterogeneous panel data of developed and emerging countries

within the framework of aggregate production function. While many studies have used static panel data in the form of Fixed-Effects (FE) or Random Effects (RE), some cross-country studies have used Integrate of order one $I(1)$ variables in the form non-stationary panel. In addition, Phillips and Moon (2000) argued that non-stationary panels require large number of periods (T) and cross-sections (N). Nevertheless, in the presence of either heteroskedasticity or serial-correlation, the variances of the FE and RE estimators are not valid and the corresponding Hausman test statistic is inappropriate (Baum, 2006). As for non-stationary panels, the variables must be stationary at first difference. However, it is possible to estimate both with the levels and first differences of the variables with the system GMM panel data method (Blundell, 1998).

The second contribution of this study is that unlike most of the previous researches that examined the nexus between economic growth and energy consumption based on bivariate model. The multivariate framework in the form of neo-classical one-sector aggregate production function with inclusion of labour and capital is used to avoid the estimation problem that rose due to omission of relevant variables. In addition, the gains from the economic growth not only depend on the degree of energy consumption but also to which labour and capital act as complements. This is because of the incorporation of capital as well as labour as additional variables emphasize not only on the relevant of these two major factors of production for economic growth but also to test the hypothesis that capital and labour as an important determinants of economic growth.

To achieve this, the rest of the paper is ordered as follows: the next section presents literature review; the data and econometric methodology used in the study are described in section three; the fourth section explains empirical results and discussion, followed by conclusions and recommendation in Section five.

2. Literature Review

This section reviewed studies that emphasize on either testing the co-movement between energy consumption and economic growth or observing the causality direction between these two variables. Although the results of the positive role of energy on economic growth has been documented in the literature, but a general conclusion from these studies is that contradictory results are still being reported. For example, Apergis (2010) employed fully modified OLS (FMOLS) and error correction model (ECM) to determine the relationship between economic growth and energy consumption covering the period 1980-2005 for nine South American countries. The results showed a long-run relationship between real GDP, energy consumption, labour force and real gross fixed capital formation. In addition, the results from FMOLS showed that energy consumption, capital and labour have a positive and statistically significant effect on economic growth. The Granger causality test results revealed the existence of both short-run and long-run causality running from energy consumption to economic growth justifying growth hypothesis.

However, Noor (2010) assessed the relationship between energy consumption and economic growth for 5 South Asian countries during the period 1971-2006, using Pedroni-cointegration technique, fully modified OLS (FMOLS) and panel error correction model. Empirical results from Pedroni-cointegration test advise a long-run equilibrium relationship among all the variables. In addition, the results from FMOLS showed that capital and energy consumption have a statistically significant and positive effect on the economic growth. However, labour exerts a statistically significant and negative effect on the economic growth. The causality test suggests a one-way causality relationship running from economic growth to energy consumption for short-and long- run and feedback causality in the long-run.

In addition, Omri (2013) applied Generalized Method of Moment (GMM) technique to examine three-way linkages between carbon emissions, energy consumption and economic growth for the panel of 14 MENA countries during the period

1990-2011. The results showed that energy consumption has a significant and positive effect on economic growth for Saudi Arabia, Algeria, Iran, Kuwait, Bahrain, Oman, Qatar, Tunisia and the UAE, while significant and negative effects on economic growth for Lebanon and Egypt. In addition, the capital has a significant and positive relationship with economic growth for 7 out of 14 countries. As for labour, the coefficient showed a negative and significant relationship with economic growth for 10 out of 14 countries.

Moreover, M. S. Kahsai, Nondo, Schaeffer, and Gebremedhin (2012) applied fully modified OLS (FMOLS) and Granger causality tests within the framework of panel error correction model to explore the relationship between energy consumption and economic growth for 40 Sub-Sahara Africa segmented into low and middle-income countries over the period 1980-2007. The authors used GDP per capita proxied for economic growth, consumer price index (CPI) proxied for prices and energy use for energy consumption. The results showed no causality relationship between energy consumption and economic growth in the short-run excluding middle-income countries. Moreover, the long-run causality revealed a bi-directional relationship between the variables for low-income countries. As for middle-income countries, the causality runs from GDP to energy consumption in the short-run and neutrality hypothesis in the long-run. Nevertheless, the coefficient energy consumption showed that has a positive as well as statistically significant influence on economic growth.

Furthermore, Pao (2013) analyzed the relationship between energy consumption and economic growth within the framework of production function where energy is treated as a separate variable for Brazil over the period 1980-2009. For economic growth, Real GDP is used as a proxy; real gross fixed capital formation is also used as proxy for capital, labour force for labour as well as total energy resources and disaggregated levels. The Johansen cointegration test and Granger causality test is based on vector error correction model (VECM) are applied. The findings suggest a long-run relationship among real GDP, real gross fixed

capital formation, labour force and each of the three clean energy consumption variables. In addition, the results from FMOLS revealed that energy consumption, capital and labour have a statistically significant and positive effect on economic growth. The Granger causality tests result evidenced short-run causality running from real gross fixed capital formation to non-renewable energy consumption and bi-directional causality between economic growth and labour force. In the long-run, there is bi-directional causality between non-renewable energy consumption and economic growth and one-way causality from renewable energy consumption to economic growth.

Al-Mulali (2014) applied autoregressive distributed lag (ARDL) bound test and Toda-Yamamoto-Dolado-Lutkepohl (TYDL) to examine the relationship between energy consumption and economic growth for six Gulf Cooperation Council (GCC) countries covering the period 1980-2012. The authors' proxied economic growth by GDP per capita measured in constant US dollars, capital by gross fixed capital formation per capita measured in constant US dollars, labour by population and energy consumption by electricity consumption, exports and imports. The results revealed that energy consumption has a long-run equilibrium relationship with economic growth.

The results of energy consumption showed a positive and significant effect on economic growth for all the countries. But, capital is positively and significantly related to economic growth for Bahrain, Oman, Saudi Arabia and the UAE, while, labour has a negative and significant effect on the economic growth for Bahrain, Oman and Saudi Arabia. The Granger causality test revealed bi-directional causality between energy consumption and economic growth for Bahrain and United Arab Emirates (UAE) while unidirectional causality running from energy consumption to economic growth for Oman and Qatar. However, no causality relationship was observed for the remaining countries.

Tang (2014) applied pooled ordinary least square (POLS), fixed-effect, random-effect and difference generalized method of moments (GMM) to examine the effect of energy consumption,

tourism and political instability on economic growth for 24 MENA countries during the period 2001-2009. The authors found that energy consumption, tourism and capital have positive and significant effect on the economic growth. However, political instability has a negative and significant effect on economic growth. Following similar methodology, applied generalized method of moments (GMM) to examine the effect of energy consumption and carbon dioxide emissions on economic growth for the panel 58 countries during the period 1990-2012. The authors found that energy consumption and foreign direct investment have a positive and statistically effect on economic growth. However, carbon dioxide emissions negatively affect the economic growth.

In addition, Raheem (2015) applied both linear and nonlinear ordinary least square (OLS) in the form of multiple regression analysis to examine the relationship between energy consumption and economic growth for 15 African countries during the period 1980-2010. The author used gross domestic product (GDP) as a proxy for economic growth, energy consumption, labour force, capital stock and export found that energy consumption has a positive and statistically significant effect on economic growth in Algeria and Zambia. However, energy consumption has a negative influence on the economic growth in Tunisia. While, capital stock has a positive and significant effect on economic growth for most of the countries under study, however, labour force has a negative and significant effect on the economic growth in Algeria and Bostwana.

Bhattacharyaa, Paramatib, Ozturkc, and Bhattacharya (2016) applied Pedroni-cointegration test, dynamic ordinary least square (DOLS) and fully modified ordinary least square (FMOLS) to examine the relationship between renewable energy consumption and economic growth for 38 top renewable energy consumption countries during the period 1991-2012. The results confirmed the existence of long-run equilibrium relationship among the variables. The results also found positive and significant effect of renewable, nonrenewable energy consumption, labour force and capital on economic growth. However, at country

specific basis, the results showed that both renewable and nonrenewable energy consumption have positive and significant effect on economic growth for most of the countries under study. While, gross fixed capital formation has a negative and significant effect on economic growth in Japan and Ireland. Moreover, labour force has a negative and significant effect on economic growth in Czech Republic, Italy, Poland, and Romania.

3. Data and Methodology

The data for this study covers 40 countries comprising both Developed and Emerging Market countries and a period of 14 years from 2000-2013. The data collected from the World Development Indicators on energy consumption, real GDP per capita, labour force and gross fixed capital formation. In order to examine the effect of energy consumption on economic growth for the countries, the study applied both dynamic and static panel estimation techniques.

3.1. Dynamic Panel Estimation Techniques

The dynamic panel estimation techniques used consist of difference and system generalized method of moments (GMM) estimator proposed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell (1998). Apart from capturing the dynamic relationship among the variables of interest, the GMM estimator would also overcome the endogeneity problem. The proposed model for this study is as follows:

$$LRGDP_{i,t} = \alpha_i + \beta_1 LRGDP_{i,t-1} + \beta_2 LGFCF_{i,t} + \beta_3 LLBFC_{i,t} + \beta_4 LENGC_{i,t} + \mu_{i,t} \quad (1)$$

where $LRGDP_{i,t}$ stands for the economic growth of a country at time t ; β 's are parameter estimates; $LRGDP_{i,t-1}$ is the lagged of dependent variable; α_i is country-specific effects assumed to be independently and constant over the countries; $LGFCF$ logarithm of gross fixed capital formation, $LLBFC$ logarithm of labour force, $LENGC$ logarithm of energy consumption, and $\mu_{i,t}$ is

the error term which is assumed to be distributed independently in all time periods of the country i . The choice of difference and system GMM are justified because the estimators are designed for situations with “small T, large N” panels, meaning few time periods and many individuals as well as independent variables that are not strictly exogenous (Roodman, 2009).

3.2. Static Panels Estimation Techniques

As a robustness check, the study observes the effect of energy consumption on economic growth using a static panel estimation technique, the appropriate model that gives them robust results is chosen;

$$LRGDP_{i,t} = \alpha_i + \nu_i + \lambda_t + \beta_1 LGFCF_{i,t} + \beta_2 LLBFC_{i,t} + \beta_3 LENGC_{i,t} + \mu_{i,t} \quad (2)$$

where: i is the number of cross-section units $i = 1, 2, \dots, N$; from 1 to N , t is the number of period $t = 1, 2, \dots, T$, $LRGDP$ is the logarithm of real GDP per capita, α is the constant parameter, β_s are coefficients of the Independent Variables, $LGFCF$ logarithm of gross fixed capital formation, $LLBFC$ logarithm of labour force, $LENGC$ logarithm of energy consumption, μ stochastic disturbance term. The choice of appropriate panel estimation model highly depends on the behavior of ν_i and λ_t . Here ν_i is the country-specific effect, while λ_t is the time-specific effect. If the time-specific effects are absent but there is country-specific effect, the estimation results with the FE model will be choosing. However, if the time-specific effects are absent but the country-specific effects characterized as random error term. Then the RE model is estimated.

4. Empirical Results and Discussion

This section presents the results and discussion for each of the panel. The result of Developed Market countries are presented first and then followed by Emerging Market countries, as well as discussion of findings.

4.1. Developed Market Countries

Table 1 : Results of Two-Step Panel Generalized Method of Moments Fixed-Effects and Random-Effects Results, Dependent Variable: Log of Real Gross Domestic Product (RGDP)

Independent Variables	Difference GMM	System GMM
RGDP _{t-1}	0.5983*** (30.41)	0.5182*** (29.72)
LENGC	0.1439*** (8.45)	0.1268*** (57.53)
LGFCF	0.1511*** (15.22)	0.1555*** (18.12)
LLBFC	0.2222*** (2.52)	0.4712*** (5.94)
Diagnostics Tests		
Number of Observation	218	218
Number of Countries	20	20
Sargan Test	22.8255[0.1550]	17.8230[0.4674]
Arrelano-Bond	-0.0020[0.9984]	-0.0934[0.1722]
AR(2) Test		

Source: Author's computation using Eviews version 9

Note: Values in () are the t-ratios, while the values in [] are the p-values.

Variables are significant at (***) 1%)

The results of both difference and system-generalized method of moments (GMM) reported in Table 1 shows that, Sargan test fails to reject the null hypothesis of over- identifying restrictions at the conventional percent level. In addition, the Arellano-Bond serial correlation test cannot reject the null hypothesis of serial correlation at order two. Since system GMM is superior estimator, the interpretation is based on it. The results show that the coefficient of lagged dependent variable is positive

and significant at 1 percent. This suggests that this year's economic growth is positively influenced by economic growth in the previous year. The coefficient of energy consumption is positive and significantly related to economic growth. Thus, a 1 percent increase in energy consumption will increase economic growth by 0.13 percent. Also, the coefficients of gross fixed capital formation and labour force have a positive and statistically significant effect on economic growth. Thus, a 1 percent increase in gross fixed capital formation and labour force lead to 0.16 and 0.47 percent increase in economic growth of Developed Market countries, respectively.

Table 2 : Fixed-Effects and Random-Effects Results, Dependent Variable: Log of Real Gross Domestic Product (RGDP)

Independent Variables	Fixed-Effects	Random-Effects
LENGC	0.1120*** (2.29)	-0.0337 (-0.81)
LGFCF	0.3103*** (11.46)	0.3044*** (11.31)
LLBFC	0.6365*** (4.77)	0.7726*** (5.10)
Constant	-1.3407** (2.02)	-0.1805 (-0.28)
Diagnostics Tests		
Number of Observations	258	258
Number of Countries	20	20
R-Square	0.9856	0.5218
F-Statistics	730.1604[0.0000]	92.3902[0.0000]
Hausman Test	33.2760[0.0000]	

Source: Author's computation using Eviews version 9

Note: Values in () are the t-ratios, while the Values in [] are the p-values.

Significant at (***) 1%) (**5%)

Table 2 provides results of panel regression model based on Fixed-Effect (FE) and Random-Effect (RE) models in order to serve as a check to robustness. To facilitate this, Hausman specification test is also carried out. Based on the results obtained from Hausman specification test, the fixed-effects model is more appropriate than its Random-Effect (RE) counterpart is, and it is therefore preferred. Similar to the results obtained in panel GMM, the Fixed-Effect reveals that energy consumption has a positive and statistically significant effect on the economic growth. While, Random-Effect results show different results with that of panel GMM even though it is not choosing by Hausman test. This implies that both panels GMM are more robust because energy consumption has positive and statistically significant at 1 percent level. As for gross fixed capital formation and labour force, their coefficients show positive and statistically significant effect on economic growth at 1 percent level. This implies that a 1 percent increase in gross fixed capital formation and labour force will lead to an increase in 0.31 and 0.64 percent level in economic growth, respectively.

4.2. Emerging Markets Countries

Table 3 provides the results of panel GMM, the instruments validity and reliability are indicated by the Sargan test and Arrelano-Bond serial correlation test AR(2), the results indicate the validity of the instruments used and the absence of serial correlation at second order. Since system GMM is superior to difference GMM, the results are interpreted based on it. Even though, the results are almost the same in terms of variables' sign with difference GMM. Nevertheless, there are some differences. The magnitude of the effect on economic growth differs by all the coefficients. That is, a 1 percent increase in energy consumption and gross fixed capital formation will lead to 0.09 and 0.11 percent increase in economic growth, respectively. However, the coefficient of labour force has a negative and significant effect on economic growth, which implies a 1 percent increase in labour force will decrease economic growth by 0.14 percent.

Table 3 : Results of Two-Step Panel Generalized Method of Moments, Dependent Variable: Log of Real Gross Domestic Product (RGDP)

Independent Variables	Difference GMM	System GMM
RGDP _{t-1}	0.5892*** (165.46)	0.7252*** (46.74)
LENGC	0.1207*** (7.02)	0.0903*** (8.10)
LGFCF	0.1721*** (18.69)	0.1105*** (10.70)
LLBFC	-0.1567*** (-3.27)	-0.1375*** (-4.40)
Diagnostics Tests		
Number of Observation	207	207
Number of Countries	20	20
Sargan Test	24.3763[0.1431]	19.4037[0.2483]
Arrelano-Bond	-1.5224[0.1279]	0.1002[0.1553]
AR(2) Test		

Source: Author's computation using Eviews version 9

Note: Values in () are the t-ratios, while the Values in [] are the p-values.

Significant at (***) 1%)

In order to perform robustness check of the estimated results, the study applied fixed effect and random effect models. To compare the fixed-effects (FE) model with random-effects (RE) model, Hausman test is applied. The value of Hausman test is significant which indicates that fixed-effects model is a better choice for the analysis as compared to random-effects model. The results of fixed effect are consistent with panel GMM where all the coefficients have a statistically significant effect on the economic growth. The point worth noting is that the magnitude of the effect of energy consumption on economic growth is lower in the two-step panel GMM. The value of R^2 for the preferred model is 0.9969, which is very good. The F-statistic measures the overall goodness of fit of the model and it is statistically significant.

**Table 4 : Fixed-Effects and Random-Effects Results,
Dependent Variable: Log of Real Gross Domestic Product
(RGDP)**

Independent Variables	Fixed-Effects	Random-Effects
LENGC	0.2581 (5.33) ***	0.2198 (4.46) ***
LGFCF	0.3937 (15.92) ***	0.4078 (16.72) ***
LLBFC	-0.3666 (-2.61) ***	-0.3879 (-2.78) ***
Constant	-2.9365 (-4.66) **	-2.7757 (-4.22)
Diagnostics Tests		
Number of Observations	247	247
Number of Countries	20	20
R-Square	0.9969	0.8699
F-Statistics	3288.1510[0.0000]	541.7480[0.0000]
Hausman Test	17.3250[0.0006]	

Source: Author's computation using Eviews version 9

Note: Values in () are the t-ratios, while the Values in [] are the p-values.

Significant at (***) 1%) (**5%) (*10%)

5. Conclusions and Policy Implications

This study examines the effects of energy consumption on economic growth for the panel of Developed and Emerging Markets over the period 2000-2013. The study applied dynamic panel method in the form of Two-Step generalized method of moments (both difference and system) GMM and static panel method in the form of Fixed-Effects and Random-Effects models in addition to the diagnostic tests in the form of Sargan test, Arrelano-Bond serial correlation test and Hausman test. The results revealed that both energy consumption and gross fixed capital formation have statistically significant and positive effect on economic growth for all the countries under study. In addition, labour force has been found to have effected positively on

economic growth in the panel of Developed Market countries. However, the study revealed that the labour force has a negative and significant effect on economic growth in Emerging Market countries.

Since the findings revealed that all the sampled countries are energy dependent, therefore, their policy makers should continue to promote the development of energy infrastructure with the aim to gain higher economic growth in making effective energy policies. This can be achieved through the allocation of more resources to the development of new sources of energy and ensure sustainability of energy use. Also, capital has been found to have effected positively on economic growth in both panels, the study suggests that in order to continue to sustain high economic growth rates, these sampled countries still need to expand their capital stock.

One way to increase the amount of capital stock in an economy is by increasing the spending on capital in the form of new tools, machinery and training. These forms of capital are the necessities of production that will increase output, which in turn stimulates economic growth. Furthermore, the study segmented the panels based on their level of developments and the effect of the coefficient of labour force is mixed, therefore, an overall “umbrella” policy recommendation would not be appropriate but individually designed strategies will go a long way in boosting the efficiency and productivity of their labour.

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Impact of Working Capital on the Profitability of UK Pharmaceuticals and Biotechnology FTSE All Share Index Firms

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Abstract

The study is conducted to investigate the impact of a working capital on profitability for the Pharmaceuticals and Biotechnology firms listed on FTSE all share index. Panel data is collected (data is collected from 2009 to 2015 for 10 Pharmaceuticals and Biotechnology firms), Pearson's correlation and fixed effect regression is used for the data analysis. Profitability is the dependent variable, which is measured through return on capital employed (ROCE). Five models have been generated based on different components of working capital (stock conversion period, debtor collection period, and creditor payment period and cash conversion cycle) in a stand-alone and collective manner to explore the impact of working capital components on the firm profitability. Four control variables (liquidity, leverage, firm size and growth) have also included in the models. The results have shown that stock conversion period has a positive while debtor collection period has a negative relationship with profitability. Insignificant results have observed for creditor payment period and cash conversion cycle therefore no relationship can be determined between these two variables with profitability. Similar results have been observed when all the working capital components were collected together to explore their impact on firm's profitability. Leverage and firm size have shown a positive relationship with profitability while insignificant results have observed for the liquidity and growth.

Keywords: ROCE, Stock conversion period, Debtor collection period, Creditor payment period, Cash conversion cycle

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1. Introduction

Working capital is the difference between the current assets and current liabilities of a company (Qurashi & Zahoor, 2017). Investment in working capital (stock, debtors and cash) is vital for the survival of the company in a short run. Working capital investment has a direct impact on the liquidity and profitability of the company. Corporate managers, who adopt an aggressive approach of working capital can generate a higher profit margin but the liquidity of their companies always remains low. The managers who practice the conservative approach of working capital are sacrificing an opportunity to generate high profit margin but the liquidity of their firms are quite high (Watson & Head, 2010). The empirical results are evident of negative relationship between the different components of working capital and profitability of the firm (Almazari, 2013; Kumaraswamy, 2016; Murthy, 2015).

Working capital is one of the vital areas for the success of any business. It is a well-established fact that a lot of UK companies have collapsed because of poor working capital and credit management (Wilner, 2000). According to Frankfurt Business Media 2012, there are about 1000 companies globally that lose about \$2 billion per year due to poor working capital management (Hoang, 2015). The empirical results have suggested that most of the firms are relying heavily on the working capital due to higher cost of external funds. Wilson (2008) has also stated that unsecured trade credit is almost 80 percent of the UK's business to business transactions while Pike and Neale (2009) have stated that debtor's amount to 19 percent of the assets of the large UK companies. Wilson (2008) has also stated that trade credit and stock of UK businesses is more than double the size of total bank credit.

Based on the above factors, this study is conducted to explore the relationship between different working capital components and the profitability of the Pharmaceutical and Biotechnology firms that are listed on FTSE all share index firms. Pharmaceutical and Biotechnology industry consists upon twelve

firms but the data for ten firms is available i.e. from 2009 to 2015. Due to this reason the sample of current study is ten firms. The study is based on panel data while descriptive statistics, correlation and regression is used for the analysis. Profit is the dependent variable that is measured through return on capital employed (ROCE). Four vital components of working capital are selected as independent variables such as stock conversion period (SCP), debtor collection period (DCP), creditor payment period (CPP) and cash conversion cycle (CCC). Four separate models are generated by using four components of working capital to explore impact of these working capital components on profitability in a stand-alone environment. Fifth model is generated by combining four components of working capital together for exploring the collective impact of four components of working capital on firm's profitability. Four control variables (liquidity, leverage, firm size and growth) are also included in the five models for controlling their impact.

Rest of the paper is divided into four sections. Section two will provide the literature review on the working capital, liquidity and profitability of the firm. Section three will provide the details on research design adopted for the study. Section four will present the results of the analysis and discussion on the findings. Section five will provide the conclusion.

2. Literature Review

From the above discussion it is clear that working capital is one of the vital factors for the success of a company as it is linked with the risk and return, growth and value of the company.

2.1. Components of Working Capital

Working capital is divided into two broader categories including current assets and current liabilities. Current liabilities have shorter maturity dates and examples are creditors and short term loans. Managers ensure that the firms have enough funds to meet the payment dates of current liabilities. However, current assets are used for the payment of current liabilities and examples of current

assets are cash, debtors and stock (Pike & Neale, 2009). Management of current assets is vital for the success of any company because the firm is bearing the cost of funds that are blocked in the current assets but the company is not able to generate any return from these funds (Watson & Head, 2010). Furthermore, if a big chunk of funds reserve for the current assets without knowing the requirement of current assets then the firm is losing an opportunity for generating higher return (Qurashi & Zahoor, 2017). Kumaraswamy (2016) has stated that for effective management of working capital, it is divided into various components such as stock conversion period (SCP), debtor collection period (DCP), creditor payment period (CPP) and cash conversion cycle (CCC).

2.2. Stock Conversion Period (SCP)

Stock conversion period is defined as the time required to convert the stock into cash (Watson & Head, 2010). Stock can be found in three forms such as raw material, work in process and finished goods and firms are making huge investment in stock to run their operating activities efficiently. Firm has to bear high costs (warehousing, insurance, opportunity cost and risk of obsolescence and pilferage) if they maintain higher inventory levels which in turn reduces profitability. For this reason managers prefer to reduce the level of stock for enhancing the firm profitability (Pike & Neale, 2009). Conflicting empirical results have been found in the existing literature. Abuzayed (2012), Makori and Jagongo (2013), Kumaraswamy (2016) have found a positive relationship between SCP and profitability while Garcia-Teruel and Martinez-Solano (2007) and Raheman, Afza, Qayyum, and Bodla (2010) have found a negative relationship between SCP and profitability.

2.3. Debtor Collection Period (DCP)

Debtor collection period is explained as the time required collecting the money from the debtors (Watson & Head, 2010). Firms sell on credit to increase the profit but credit sales require additional investment in debtor, processing and collection of payments from debtors. Tight credit policy reduces the sales and

probability that debtors will default whereas relaxed credit policy increases sales and probability of default. Due to the above factors associated with debtors, effective management of debtors is required so the profit margin of the company can be increased (Pike & Neale, 2009). Conflicting empirical results were also found in the existing literature regarding DCP and profitability. Mathuva (2010), Majeed, Makki, Saleem, and Aziz (2012), Kumaraswamy (2016) have found a negative relationship between DCP and profitability while Sharma and Kumar (2011), Abuzayed (2012), Murthy (2015) have found a positive relationship between DCP and profitability.

2.4. Creditor Collection Period (CCP)

Creditor collection period is the time taken by the creditors to pay for the credit purchases (Watson & Head, 2010). Normally the creditors are using different payment strategies to linger on the payment for reducing the cost of trade credit. The efficient creditor management allows the firm to enhance its liquidity and reduces burden on the future cash flows that increases the profit margin (Berk, DeMarzo, & Hardford, 2014). The empirical results have shown the insignificant relationship between CCP and the profitability of the firm (Almazari, 2013; Kumaraswamy, 2016).

2.5. Cash Conversion Cycle (CCC)

Cash conversion cycle is defined as the time from the purchase of raw material to the recovery of payment from credit customers. CCC is dependent on the management of SCP, DCP and APP because these are the components of CCC. The efficient firms are buying raw material on extended credit time and reducing their own investment on the purchase of stock for reducing their CCC. Reduction in CCC assists the firm to increase the firm's profitability (Watson & Head, 2010). The empirical results have shown the negative relationship between the CCC and firm's profitability (Anser & Malik, 2013; Kumaraswamy, 2016; Pais & Gama, 2015; Upadhyay, Sen, & Smith, 2015).

3. Methodology

The aim of the study is to investigate the impact of working capital on the profitability of the UK Pharmaceutical and Biotechnology firms listed on FTSE all share index firms. Pharmaceutical and Biotechnology industry of FTSE all share index consists upon twelve firms but the data for only ten firms is available from 2009 to 2015. For this reason the panel data for the ten Pharmaceutical and Biotechnology firms is collected for the analysis.

Descriptive statistic, correlation and multiple regression tools were utilized for the data analysis of this study. Profitability is the dependent variable and it is measured through return on capital employed (ROCE). Working capital is the independent variable and it is measured through its different vital components such as stock conversion period (SCP), debtor collection period (DCP), creditor payment period (CPP), cash conversion cycle (CCC). Furthermore, various control variables are also included in the analysis for controlling their effect such as liquidity, leverage, firm size and growth. Five following multiple regression models were constructed based on various working capital components to explore their impact on the profitability of the firm.

Model 1

$$ROCE_{it} = \beta_0 + \beta_1(SCP_{it}) + \beta_2(LIQ_{it}) + \beta_3(LEV_{it}) + \beta_4(FMSZ_{it}) + \beta_5(GRO_{it}) + \varepsilon$$

Model 2

$$ROCE_{it} = \beta_0 + \beta_1(DCP_{it}) + \beta_2(LIQ_{it}) + \beta_3(LEV_{it}) + \beta_4(FMSZ_{it}) + \beta_5(GRO_{it}) + \varepsilon$$

Model 3

$$ROCE_{it} = \beta_0 + \beta_1(CCP_{it}) + \beta_2(LIQ_{it}) + \beta_3(LEV_{it}) + \beta_4(FMSZ_{it}) + \beta_5(GRO_{it}) + \varepsilon$$

Model 4

$$ROCE_{it} = \beta_0 + \beta_1(CCC_{it}) + \beta_2(LIQ_{it}) + \beta_3(LEV_{it}) + \beta_4(FMSZ_{it}) + \beta_5(GRO_{it}) + \varepsilon$$

Model 5

$$ROCE_{it} = \beta_0 + \beta_1(SCP_{it}) + \beta_2(DCP_{it}) + \beta_3(CPP_{it}) + \beta_4(CCC_{it}) + \beta_5(LIQ_{it}) + \beta_6(LEV_{it}) + \beta_7(FMSZ_{it}) + \beta_8(GRO_{it}) + \varepsilon$$

From Model 1 - 4 only one working capital component is there in the regression equation with four control variables. This process is adopted to explore the impact of each working capital component on the profitability of the firm. All four working capital ratios are combined in the Model 5 to explore the collective impact of working capital ratios on the profitability. But higher level of multicollinearity has been found between credit payment period (CCP) with other variables. For this reason Model 6 is constructed by eliminating CPP from Model 5 to explore the collective impact of remaining working capital ratios on the firm's profitability. Model 6 is provided below

Model 6

$$ROCE_{it} = \beta_0 + \beta_1(SCP_{it}) + \beta_2(DCP_{it}) + \beta_3(CCC_{it}) + \beta_4(LIQ_{it}) + \beta_5(LEV_{it}) + \beta_6(FMSZ_{it}) + \beta_7(GRO_{it}) + \varepsilon$$

Where, i shows number of cross-sections and t shows time period.

3.1. Measurement of the Variables and Associated Hypotheses

This section provides the information regarding the measurement of different variables that are used for the current analysis.

3.1.1. Return on Capital Employed (ROCE)

Return on cash employed is used to measure the profitability of the firm. ROCE is a vital profitability ratio that provides information about the return generated by the firm on the total investment (long term equity and debt) of the firm (Pike & Neale, 2009). For this study ROCE is calculated by dividing net profit before tax on total debt plus total equity as it is calculated by Saleem and Rehman (2011) in their study. There are different weaknesses of using

ROCE. Firstly, ROCE is based on accounting numbers that are exposed to manipulation. Secondly, book values are used for the calculation of ROCE that are not providing recent information about the performance of the company. Even though ROCE has the above weaknesses but it is considered as the most comprehensive measure of profitability (Watson & Head, 2010).

3.1.2. Stock Conversion Period (SCP)

Stock conversion period is an important working capital ratio that provides information that how much time is required by the company for converting its stock into cash (Pike and Neale, 2009). Lower SCP is appreciated by the stakeholders because less funds are needed for the stock management, which ultimately decreases the cost of capital and increases the profitability (Watson & Head, 2010). SCP is calculated by dividing stock on the cost of goods sold multiplied by 365 as calculated by various researcher in their studies (Eljelly, 2004; Hoang, 2015; Kumaraswamy, 2016; Raheman & Nasr, 2007; Vural, Sokmen, & Cetenak, 2012; Zygmunt, 2013). The following hypothesis is generated for exploring the relationship between SCP and profitability.

H₁: No relationship exists between stock conversion period and firm's profitability.

3.1.3. Debtor Collection Period (DCP)

Debtor collection period is also a vital working capital ratio that provides information regarding the management of debtor by the company (Watson and Head, 2010). Lower DCP is highlighting that the managers are effectively implementing the debtor management that is assisting them to reduce the cost of capital and increasing the profit margin of the company (Pike & Neale, 2009). DCP is calculated by dividing debtors on the revenue and then multiplied it with 365 as calculated by various researchers in their studies (Eljelly, 2004; Hoang, 2015; Kumaraswamy, 2016; Raheman & Nasr, 2007; Vural et al., 2012; Zygmunt, 2013). The following hypothesis is generated between the two variables.

H₂: No relationship exists between debtor collection period and firm's profitability.

3.1.4. Cash Conversion Cycle (CCC)

Cash conversion cycle highlights the number of days spent by the company from buying the raw material for recovering the cash from all its customers (Watson & Head, 2010). Completion of the above mentioned process in less time is in the best interest of the company because it increases the profit margin (Pike & Neale, 2009). CCC is calculated by deducting creditor payment period from the aggregate of debtor collection period and stock conversion period as calculated by various researcher in their studies (Eljelly, 2004; Hoang, 2015; Kumaraswamy, 2016; Raheman & Nasr, 2007; Vural et al., 2012; Zygmunt, 2013). The following hypothesis is generated between the CCC and profitability.

H₃: No relationship exists between cash conversion cycle and firm's profitability.

3.1.5. Liquidity (LIQ)

Liquidity is measured through current ratio (CR), which is the most common ratio for calculating the liquidity of the firm (Watson & Head, 2010). The empirical results have shown the negative relation between liquidity and the profitability of the firm because investment in current assets is not generating any return for the companies (Pike & Neale, 2009). CR is calculated by dividing current assets on the current liabilities and this ratio is used by various researchers in their studies (Ahmed, 2016; Kumaraswamy, 2016; Raheman & Nasr, 2007; Zygmunt, 2013). The following hypothesis is generated to explore the relationship between the two variables.

H₄: No relationship exists between liquidity and the firm's profitability.

3.1.6. Leverage (LEV)

Leverage has a significant impact on the firm's profitability due to the tax shield benefit that reduces the cost of capital and increases the profit margin (Dhaliwal, Heitzman, & Li, 2005). But the existence of leverage in the financing structure of the firm put lot of pressure on management to perform efficiently (Akintoye, 2008). Different researchers have also pointed out that only those firms attain the benefit of leverage that can generate optimal capital structure (where tax shield benefit is higher than the associated leverage costs) for the firms (Titman & Wessles, 1988; Upneja & Dalbor, 2001). Different researchers who have conducted their studies in the area of working capital and profitability and used leverage as the control variable have found negative relationship between leverage and profitability (Christopher & Kamalavalli, 2009; Mathuva, 2010; Samiloglu & Demirgunes, 2008). Even conflicting results have been found but this study will test the following hypothesis between leverage and profitability.

H₅: No relationship exists between leverage and firm's profitability.

3.1.7. Firm Size (FMAE)

Firm size has an impact on profitability. Normally large firms can attain economies of scale that assist the firm to reduce the cost per unit that can increase the profit margin of the firm but smaller firms are not in a position to attain these benefits (Hardwick, 1997). Large companies have bargaining power that also assists these companies to reduce the production cost and increases the profitability. The large firms can also generate credit at the cost that is also an advantage to these firms (Yang & Chen, 2009). Another benefit is that large firms can hire the best human resource for achieve the corporate objectives effectively (Inmyxai & Takahashiin, 2010). The smaller firms cannot attain the above benefits and struggling to complete with the large firms (Majumdar, 1997). Therefore, it can be stated that the size of the

firm has an impact on firm's profitability and the following hypothesis is generated for the two variables.

H₆: No relationship exists between firm size and firm's profitability.

3.1.8. Growth (GRO)

Deloof (2003) has stated that growth has the positive impact on the profitability of the firm. Normally the stock market returns are higher for the growing firms because the growing firms have the potential to increase the firm's profitability that ultimately leads to the maximization of shareholder wealth (Shin & Soenen, 1998). Based on the positive results of various research studies, this study will test the following hypothesis between growth and profitability.

H₇: No relationship exists between growth and firm's profitability.

4. Analysis and Discussion

Different statistical tools were used for the data analysis such as descriptive statistics, correlation and multiple regressions. The results of descriptive statistics are provided in the Table 1.

Table 1 : Descriptive Statistics for Pharmaceutical and Biotechnology Firms

Variable	N	Range	Min.	Max.	Mean	S.D
ROCE	60	3.82	-1.97	1.85	0.12	0.49
SCP	60	417.14	0.00	417.14	161.25	94.49
DCP	60	239.03	11.74	250.77	93.12	41.60
CCC	60	9918	-9744	173.18	-678	1558
LIQ	60	6.05	0.46	6.51	1.99	1.13
LEV	60	347.78	0.07	347.85	9.52	51.07
FMSE	60	3.80	6.73	10.53	8.94	1.15
GRO	60	12.21	-0.90	11.31	0.24	1.49

Table 1 presents the results of descriptive statistics for the Pharmaceutical and Biotechnology firms that are constituents of FTSE all share index. Descriptive statistics is used to provide a brief summary of the data collected for the analysis. The main

descriptive analysis tools used for the study are the number of observations, range, minimum, maximum, mean and standard deviation.

Table 2: Correlation for Pharmaceutical and Biotechnology Firms

	ROCE	SCP	DCP	CCC	LIQ	LEV	FMSE	GRO
ROCE	1							
SCP	0.224	1						
DCP	-0.245	0.169	1					
CCC	0.202	-0.251	-0.232	1				
LIQ	-0.136	0.116	0.252	-0.536	1			
LEV	0.465	-0.041	0.210	-0.019	0.295	1		
FMSE	0.329	0.024	-0.483	0.390	-0.511	-0.336	1	
GRO	-0.005	-0.021	-0.266	0.077	-0.017	-0.053	0.104	1

Table 2 presents the results of correlation for the Pharmaceutical and Biotechnology firms that are constituents of FTSE all share index. Pearson correlation is calculated to explore how different variables are moving together. As discussed before that in the presence of creditor payment period, higher level of multicollinearity has found. For this reason creditor payment period has eliminated. Higher level of correlation has not been found in the absence of creditor payment period.

Five multiple regression models have been generated for exploring the impact of various components of working capital in stand-alone environment and collectively on the profitability of the firm. The results of these multiple regression models are provided below.

Table 3 : Results of Multiple Regressions for Model 1

	Coefficients		Significance level
SCP	0.228		0.019
LIQ	0.065		0.633
LEV	0.652		0.000
FMSE	0.591		0.000
GRO	-0.026		0.777
R ²	0.54	Adjusted R ²	0.497
F.Statistics	12.670	Sig (F)	0.000

Only one working capital component (stock conversion period) and four control variables are added in the Model 1 to explore the impact of stock conversion period on the profitability. The F statistics highlights that the model is highly significant. R square shows that independent variables are explaining 54 percent impact on profitability. The results have shown that stock conversion period has a significant positive impact on the profitability so the hypothesis is rejected and it is stated that a positive relationship exists between stock conversion period and profitability. The results are similar (Abuzayed, 2012; Kumaraswamy, 2016; Makori & Jagongo, 2013) and against (García-Teruel & Martínez-Solano, 2007; Raheman et al., 2010) the different empirical studies. The main reason for this positive relationship is that the selected firms are increasing their stock level for meeting the increased sales demand in order to enhance the firm's profitability.

Table 4 : Results of Multiple Regression for Model 2

		Coefficients	Significance level
DCP		-0.160	0.016
LIQ		0.102	0.463
LEV		0.649	0.000
FMSE		0.549	0.001
GRO		-0.069	0.490
R ²	0.508	Adjusted R ²	0.462
F-Statistics	11.144	Sig (F)	0.000

Debtor collection period is added in the Model 2 with other control variables. The model is highly significant which can be seen from the results of F statistics. R square is highlighting that the independent variables have approximately 51 percent impact on profitability. Significant negative results were observed between debtor collection period and profitability so the hypothesis has been rejected and it is stated that negative relationship exists between the two variables. The negative relationship was expected because the firms are normally putting their best efforts for collecting the cash from their customers as soon as possible. Furthermore, it shows that the selected companies are effectively managing the debtor to increase profitability. The result of the

current study is in line with Mathuva (2010), Majeed et al. (2012), Pais and Gama (2015), Kumaraswamy (2016) while different from Sharma and Kumar (2011), Abuzayed (2012) and Murthy (2015).

Table 5 : Results of Multiple Regression for Model 3

	Coefficients		Significance level
CCP	-0.038		0.748
LIQ	0.150		0.333
LEV	0.633		0.000
FMSE	0.637		0.000
GRO	-0.039		0.696
R Square	0.491	Adjusted R Square	0.444
F-Statistics	10.410	Sig (F)	0.000

Creditor collection period along with four control variables is used in Model 3. The model is highly significant as F statistics is 0.000. Independent variables have approximately 49 percent impact on profitability. Highly insignificant results for creditor collection period and profitability are observed so the hypothesis between the two variables is accepted and it can be stated that no relationship exists between creditor collection period and profitability.

The result of this study is consistent with the other empirical studies where other researchers also found the insignificant results between creditor collection period and profitability (Almazari, 2013; Kumaraswamy, 2016).

Table 6 : Results of Multiple Regression for Model 4

	Coefficients		Significance level
CCC	0.054		0.649
LIQ	0.159		0.305
LEV	0.630		0.000
FMSE	0.636		0.000
GRO	-0.040		0.688
R ²	0.492	Adjusted R ²	0.445
F-Statistics	10.451	Sig (F)	0.000

Cash conversion cycle is added in the Model 4 with other four control variables. The model is highly significant which can

be seen from the F statistics. R square is highlighting that the independent variables have approximately 49 percent impact on profitability. Insignificant results were observed between cash conversion cycle and profitability so the hypothesis is accepted and it is stated that no relationship exists between cash conversion cycle and profitability. The current results are not in line with the results of other empirical studies Anser and Malik (2013), Pais and Gama (2015), Upadhyay et al. (2015) and Kumaraswamy (2016).

Table 7 : Results of Multiple Regression for Model 6

		Coefficients	Significance level
SCP		0.296	0.003
DCP		-0.232	0.040
CCC		0.102	0.362
LIQ		0.063	0.665
LEV		0.653	0.000
FMSE		0.442	0.004
GRO		-0.079	0.399
R ²	0.584	Adjusted R R ²	0.529
F-Statistics	10.449	Sig (F)	0.000

The Model 6 is different from other four Models because three components of working capital are added in this model with four control variables. Significant positive results for stock conversion period and profitability have been observed that are helpful to state that positive relationship exists between stock conversion period and profitability. Significant negative results have been observed between debtor collection period and profitability so it is stated that negative relationship exists between the two variables. Insignificant results have been observed for cash conversion cycle so no relationship between cash conversion cycle and profitability can be determined.

As discussed that four control variables (liquidity, leverage, firm size and growth) have also added in all the Models. Similar results for the control variables have been observed for all five models. Significant positive results have been observed for leverage so the hypothesis is rejected and it is stated that leverage has a positive relationship with profitability.

It was already expected that leverage and profitability are moving in the same direction due to the tax shield benefit. Significant positive results have also been observed for firm size so the hypothesis is also rejected and it is stated that firm size has a positive relationship with profitability. Positive relation was also expected between the two variables because the large firms have different advantages on their smaller counterparts such as economies of scale, higher bargaining power, spend more on research and development and can hire highly professional human resources. Insignificant results for liquidity and growth have been observed so the hypotheses regarding these two variables are accepted and it is stated that no relationship exists between liquidity and growth with profitability.

5. Conclusions

The study was conducted to explore the impact of working capital on profitability for Pharmaceutical and Biotechnology firms that are the constituents of FTSE all share index. Secondary and quantitative data is collected from the annual reports of the firms. Twelve firms come under Pharmaceutical and Biotechnology industry but the data for only ten firms were available from 2009 – 2015. In this way panel data is used for the study with the fixed effect model. Different statistical tools were used for the data analysis such as descriptive statistics, correlation and regression. Five different models were generated by using various working capital components for exploring their impact on profitability in a stand-alone and collectively manner.

The results of F-statistics have shown that all the models were statistically significant. The R square is in the range of 58 percent to 49 percent which shows the working capital components have a reasonable impact on the profitability. The results have shown that stock conversion period has a positive relationship with profitability. The possible explanation of this positive relationship is that the selected firms are increasing the stock level because their revenues are growing year after year. The results have shown that debtor collection period has a negative relationship with profitability as expected. The main reason for this negative

relationship is that the managers are effectively managing their debtors to increase the profitability of the firm. Insignificant results have been observed for creditor payment period and cash conversion cycle so no relationship can be determined for these two working capital components with profitability. Similar results have been found when different working capital components were collected together in Model 6.

Four control variables were also included in the analysis. The results have shown that leverage and firm size have a significant positive relationship with profitability so the hypotheses for leverage and firm size are rejected and it is stated that leverage and firm size have a positive relationship with profitability. Insignificant results for liquidity and growth have been observed so the hypotheses regarding these two variables are accepted and it is stated that no relationship exists between liquidity and growth with profitability.

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Environmental Kuznets Curve: A Times Series Evidence from Pakistan

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Abstract

In this paper, the Environmental Kuznets Curve (EKC) is used to investigate the connections between CO₂ emissions, energy consumption, economic growth, trade openness and urban population in Pakistan over the period of 1971-2010. The Autoregressive distributed lag (ARDL) bounds testing approach to co-integration has been taken for long run relationship, and for the short run dynamics Granger causality considered within the vector error correction model (VECM). The study presents that energy consumption, trade openness and urban population serve as the main factors contributing to CO₂ emissions in the long run. The results are in line with hypothesis in long run, and in short run inverted U-shape relation was found between CO₂ emissions and the economic growth. Trade openness and urban population Granger are responsible for CO₂ emissions. The facts about the existence of an EKC relation can help the policy makers in creating all-inclusive economic and environmental policies for the sustainable economic growth, and preserve clean environment.

Keywords: EKC, ARDL, VECM, CO₂

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1. Introduction

Climate change has been worldwide attention seeker towards the global environment issues. Many studies examined the connection between economic growth, energy consumption, carbon dioxide (CO₂) emissions and per capita income over the last two decades (Dindas, 2004).

For researchers, it also became the main focus from different science fields. In this context, the link of economic development and environmental performance is considered the main concentration of increasing attention. The issue of environmental degradation whether it raises monotonically, declines monotonically, or grows at initial stages and then declines in the transitional stages of development, undergoes critical suggestions for policy. Whereas development through industrial sector in an economy causes increase in income and welfare, this shows to act like “*magnifier*” of environmental degradation. On the other hand, rising environmentalism tends to act like an impediment to economic development. Economic growth through fast industrialization and increasing environmental awareness both have raised a question how economic growth may be connected with environment (Dindas, 2004).

The relation of environmental quality with economic development aroused much debate in the last decade (i.e.; 1990) and considerable literature on the environmental degradation and economic growth relationship has augmented in recent period. The World Development Report (1992) concluded cross-sectional evidences on the relation among various environment quality indicators and income per capita between different countries (Dindas, 2004). Other studies¹, have examined an inverted-U shaped association between environment filth and income. The mutual argument of all studies is the claim that the environment deteriorates at initial phases of development but after a level of income per capita, the trend converses as income cross the threshold levels shown in figure (Stern, 2004). In earlier stages of growth, environmental pressure rises rapidly than the income and slows down in higher levels relative to GDP growth. This

systematic inverted connection is called the Environmental Kuznets Curve (EKC) following the concept presented by Kuznets (1995).

The EKC narrates the problem of the effect of economic development on environment. In order to understand this phenomenon, one should consider the fact, why and how economic development issues get connected to Concerns concerning the environmental degradation requires a well-organized study. Basically, detailed studies are required to understand the shape and the specific nature of Environmental Kuznets Curve (EKC). Re-examination of connection between economic growth and environment quality thus remains an open issue.

The EKC results propose that the economic growth can be compatible with the environmental improvements provided suitable policies are taken. Simultaneously, the effective policies can be introduced in case income increases. However, it is important to understand the nature and the casual linkages between economic growth and environmental quality before introducing an effective policy (Dindas, 2004).

1.1. Environment Condition of Pakistan Economy

Economic growth can be promoted by attaining sustainable environmental development. Numerous remedial actions have been taken by Government of Pakistan throughout the country towards the sustainable economic growth. In 2005, the Government of Pakistan introduced National Environmental Policy (NEP). The main objectives of NEP were to conserve and to restore and to protect the natural atmosphere of Pakistan, to improve the standard of living of the citizens by sustained economic growth. Economic development is reinforced by all sectors including industry, agriculture and services as well. The increasing economic growth in Pakistan is due to the development of the manufacturing sectors especially in contributing the country national savings². The economic growth in all sectors particularly in industrial sector; increased energy demand and resulted increase in environmental degradation (i.e. water pollution, air pollution, emissions etc.).

During 2002-2003, the total energy used by industrial sector is 36% whereas 33% is used by transportation.

In Pakistan, higher consumption of petroleum in transport sector is a major cause of high emissions of CO₂. Most of the CO₂ emissions are emerging from gas combustion mostly added by power production and consumption of coal adds approximately 50% of the CO₂ emissions of natural gas. Pakistan added 0.4% of total world CO₂ emissions in 2005, and this “contribution of emissions” is increasing day by day.

The purpose of the study is to examine empirically the Environmental Kuznets Curve (EKC) hypothesis in case of Pakistan, by analyzing data (time series) from year 1971 to 2010.

2. Literature Review

Emissions of CO₂ are directly associated with energy consumption since each extra energy consumption results in higher level of economic growth but it produces high emissions (Apergis & Payne, 2010). Ang (2007) discussed the link between output, energy consumption and pollutant emissions. The study found that all these variables were interrelated and thus the variables relation must to be analyzed for co-integration and Vector Error Correction (VEC) modeling. The empirics give data support a vigorous long relationship among variables. The causality result indicates that GDP has a casual impact on the consumption of energy and pollution in long run whereas; the outcomes of short-run indicated a unidirectional causality from energy consumption towards the GDP. This study was extended by Apergis and Payne (2010) by analyzing the casual link amongst energy consumption, CO₂ emission and GDP using a panel VEC model for six Central American countries (El Salvador, Cost Rica, Honduras, Guatemala, Panama and Nicaragua) for the period of 1971-2004 and also for eleven commonwealth countries (Azerbaijan, Armenia, Belarus, Kazakhstan, Georgia, Russia, Moldova, Tajikistan, Kyrgyzstan, Ukraine and Uzbekistan), respectively. For long run, the study concluded that, the energy consumption has significantly positive connection with emissions but the real GDP

showed an inverted U shaped pattern related with EKC hypothesis. For short run, dynamic relation showed causality (unidirectional) from GDP and energy consumption towards emissions and bi-directional causality amongst real GDP and energy consumption. Whereas, in long run the causality (bi-directional) was found amongst energy consumption and real GDP.

Apergis and Payne (2010) adopting co-integration and unit root test approaches to discover the connection between energy consumption, CO₂ emissions, and GDP for twelve (12) Middle East and North America (MENA) countries for the period of 1981-2005. The results show that energy consumption has a significantly positive effect on emissions in the long run whereas real GDP revealed a quadratic relation with CO₂ emissions in total for this region. However, long run estimates of per capita income and its square respectively support the EKC hypothesis in most examined countries. The critical points are lower in several cases while higher in others, hence providing weak evidence in favor of EKC hypothesis. The policy implication of the MENA reveals that reduction in CO₂ emissions achieved in MENA countries showed economic development and the region proves that reduction in future CO₂ emissions might be attained at the same time as GDP achieved in MENA.

Hossain (2011) discussed about the significance of urbanization in the connection amongst trade, CO₂ emissions, GDP and consumption of energy. The exact outcomes demonstrate the dynamic causal connection between each one of these factors in the setting of recently industrialized nations (NIC: China, Brazil, Mexico, South Africa, India and Turkey) by utilizing data of period 1971-2007. Panel root outcomes show that factors are cointegrated of order 1, I(1). Johansen panel co-integration test outcomes give that there exist a co-integration vector error among the factors. The Granger Causality examination bolster that there was no indication of long run causal relationship, however there was unidirectional short run causality from GDP and trade openness towards CO₂ emanations, from GDP to energy consumption, from exchange receptiveness towards GDP, from urban populace to GDP, from trade openness to urbanization. The

investigation found that the elasticity of CO₂ emission with a specific end goal to energy consumption was greater than the short-run. This infers energy consumption in NIC for 1971-2007 presents' increment in additional CO₂ emissions leaving a negative effect over environment. But as for GDP, trade openness and urbanization observed to be balancing out the environment over the long run. In addition to the above writing, there have been various studies talking about the hypothesized relationship of EKC.

3. Theoretical Model

The study used multivariate model analysis techniques to investigate the effect of energy consumption, urbanization, trade openness and per capita income on carbon emissions in case of Pakistan. The relationship among variables can be expressed as;

$$C_t = f(Y_t, Y_t^2, E_t, TR_t, U_t) \quad (1)$$

Where C stands for carbon emissions (per capita), E is energy consumption, whereas, Y represents real GDP (per capita) and Y² refer to its square, U refers to urban population (as a share of total population), TR denotes trade openness (per capita). The relationship can be stated in an equation follows;

$$C_t = \beta_1 + \beta_Y Y_t + \beta_Y^2 Y_t^2 + \beta_E E_t + \beta_{TR} TR_t + \beta_U U_t + \mu_t \quad (2)$$

The study used log-linear model as it gives more efficient and appropriate results. In logarithmic form the equation (2) can be modified as follows:

$$\ln C = \beta_1 + \beta_Y \ln Y_t + \beta_Y^2 \ln Y_t^2 + \beta_E \ln E_t + \beta_{TR} \ln TR + \beta_U \ln U_t + \mu_t \quad (3)$$

Where μ_t is the error term, we constructed a hypothesis that, the economic activities cause a rise in energy consumption, resulting increase in the energy use. This leads us to expect that $\beta_E > 0$. The Environmental Kuznets Curve hypothesis suggests that $\beta_Y > 0$ and $\beta_Y^2 < 0$. The trade openness $\beta_{TR} < 0$, if the production of the pollutant intensive products is decreased because of

environmental regulations and take such products from developed countries which have flexible environmental laws. Other studies such as Grossman & Krueger (1991) and (Halicioglu, 2009)) claims that β_{TR} has positive sign ($\beta_{TR} > 0$) if industrial sector of developing countries are involved in producing more CO₂ emissions. Finally, population specifies the proxy urbanization through urban share of total population. Urbanization shows demographic growth on environment. This increase in urban population cause greater demand for energy which may result in more pollution. Therefore, we expect $\beta_U > 0$.

4. Methodology

4.1. Data

Data for the analysis covering the period of 1971-2010 and was selected due its easy accessibility. Data used for estimation purpose are GDP and energy consumption, carbon dioxide (CO₂) and trade ratio. Data for the study had collected from World Development Indicator (WDI) where GDP per capita and its square respectively, (E) energy consumption, CO₂ emissions (C), trade openness (TR) ratio and urban population (U) of large cities as share of total population.

4.2. Estimation Strategy

4.2.1. Testing for Non-stationarity Property and Order of Integration

Analyzing the time series properties or non-stationary properties of the variables are imperatives, and the use of Ordinary Least Square (OLS) techniques with non-stationary variables can provide spurious outcomes. Thus, before further estimation of the variables, it is necessary to investigate stationary. For this purpose, the study used a unit root test (Dickey & Fuller, 1979) to examine the variable whether non-stationary, and if non-stationary the integration order is the same or not.

4.2.2. Augmented Dickey Fuller (ADF) Test

The Augmented Dicky Fuller (ADF) tests are applied for the existence of unit roots among the variables and determine the integration order of the variables. The ADF test requires the following equations;

$$\Delta y_t = \alpha_0 + \alpha_1 t + \theta y_{t-1} + \sum_{i=1}^m w_i \Delta y_{t-i} + \epsilon_t \quad (4)$$

Where, Δ represents the difference operator, y represent the series being tested, $t-1$ shows the number of lagged differences and ϵ stand for error term

4.2.3. Bound Testing Approach for Co-integration

After the existence of the unit roots among the variables, the study applied autoregressive distributed lag (ARDL) model techniques to establish the long run relationships between energy consumption, CO₂ emissions, trade openness, per capita income and urbanization. ARDL approach is superior to co-integration since it provides more authentic results in case of small samples such as in our case. Unrestricted Error Correction Model (UECM) has flexibility to incorporate lags which captures the data creating method with agenda (general to specific) of specification (Laurenceson & UK, 2003).

The following UECM is employed for this study;

$$\Delta \ln C_t = \alpha_0 + \alpha_T T + \sum_{i=1}^p \varphi_i \Delta \ln C_{t-i} + \sum_{i=0}^q \chi_i \ln Y_t + \sum_{i=0}^r \sigma_i \Delta \ln Y_t^2 + \sum_{i=0}^r \varepsilon_i \Delta \ln E_t + \sum_{i=0}^y \omega_i \Delta \ln T_t + \sum_{i=0}^s \Omega_i \Delta \ln U_t + \lambda_c \ln C_t + \lambda_Y \ln Y_t + \lambda_Y^2 \ln Y_t^2 + \lambda_E \ln E_t + \lambda_{TR} \ln TR_t + \lambda_U \ln U_t + \mu_t \quad (5)$$

Where $\varphi, \chi, \sigma, \varepsilon$ and ω shows the short, and $(\lambda_c, \lambda_Y, \lambda_Y^2, \lambda_E, \lambda_{TR}, \lambda_U)$ represents the long run connections amongst the variables. The null hypothesis (showing no-co-integration between variable) is

$$H_0: \lambda_c = \lambda_Y = \lambda_Y^2 = \lambda_E = \lambda_{TR} = \lambda_U = 0.$$

whereas, the alternate hypothesis (showing co-integration between variables) is

$$H_1: \lambda_C = \lambda_Y = \lambda_{Y^2} = \lambda_E = \lambda_{TR} \neq \lambda_U = 0$$

The presence of co-integration relies on the calculated value of F-statistic.

4.2.4. Granger Causality

The Granger test suggests that Granger Causality exists at least in one direction if there is co-integration among the series in Eq (2) providing that the series are integrated order of one, i.e. I(1). Enger and Granger (1987) caution that the Granger Causality test based on the Vector Auto Regressive (VAR) technique in the first difference in the existence of long run relationship may produce inconsistent results in the existence of co-integration. So, adding a variable the Error Correction Term (ECT) will be helpful to check long run connection.

The error correction term formulated on the Granger Causality test in multivariate p th order vector error correction model.

$$(1-L) \begin{bmatrix} \ln C_t \\ \ln Y_t \\ \ln Y_t^2 \\ \ln E_t \\ \ln TR_t \\ \ln U_t \end{bmatrix} = \begin{bmatrix} \phi_1 \\ \phi_2 \\ \phi_3 \\ \phi_4 \\ \phi_5 \\ \phi_6 \end{bmatrix} + \sum_{i=1}^p (1-L) \begin{bmatrix} a_{11t} a_{12t} a_{13t} a_{14t} a_{15t} a_{16t} \\ b_{21t} b_{22t} b_{23t} b_{24t} b_{25t} b_{26t} \\ \delta_{31t} \delta_{32t} \delta_{33t} \delta_{34t} \delta_{35t} \delta_{36t} \\ \pi_{41t} \pi_{42t} \pi_{43t} \pi_{44t} \pi_{45t} \pi_{46t} \\ \theta_{51t} \theta_{52t} \theta_{53t} \theta_{54t} \theta_{55t} \theta_{56t} \\ \sigma_{61t} \sigma_{62t} \sigma_{63t} \sigma_{64t} \sigma_{65t} \sigma_{66t} \end{bmatrix} + \begin{bmatrix} \beta \\ \chi \\ \xi \\ \zeta \\ \rho \\ \psi \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \eta_{1t} \\ \eta_{2t} \\ \eta_{3t} \\ \eta_{4t} \\ \eta_{5t} \\ \eta_{6t} \end{bmatrix} \quad (6)$$

(1-L) show lag operator, ECM_{t-1} is lagged error-correction term; Significant F-statistic provides evidence of the parameters of the 1st differences series on short run causality direction, but the long run causality capture through t-statistic significance level pertaining towards ECM_{t-1} .

5. Results and Discussion

The fundamental step in this study was involved to examine the unit roots via augmented Dickey-Fuller test (Dickey & Fuller,

1979). Table 1 represents all variables were integrated of order I except for trade openness (TR), which indicates that all the variables were stationary at their first difference.

Table 1: Unit Root Estimation

Variables	Constant and Trend. At Level P value	Constant and Trend. At 1st difference P value	Order of Integration
$\ln C_t$	0.5243	0.0000	I(1)
$\ln Y_t$	0.5160	0.0000	I(1)
$\ln Y_t^2$	0.6272	0.0001	I(1)
$\ln E_t$	0.8145	0.0000	I(1)
$\ln TR_t$	0.0005		I(0)
$\ln U_t$	0.6332	0.0001	I(1)

The ARDL bounds test statistic requires lag length of variables. The lag length 2, selected using AIC as represented in Table 2.

Table 2: Criteria of selection of lag length : Var Lag Order Selection Criteria

Lag	LogL	R	FPE	AIC	SC	HQ
0	109.0412	NA	0.0001	-5.7245	-5.4605	-5.6323
1	110.6160	2.5371	0.0001*	-5.7356	-5.3826	-5.6489
2	111.2221	0.9428*	0.0001	-5.7345*	-0.3826*	-5.6117*

Note: * shows 10% level of significance

Table 3: Co-integration Test Results

Bounds Testing to Co-integration				Diagnostic Tests		
Estimated Models	F-Statistics	B-Godfrey LM Test	ARCH LM test	Adjusted R²	J-B Normality	Heteroskedasticity test
$F_C(C/Y, Y^2, E, TR, U)$	12.0401	0.6536	0.5414	0.8488	0.0050	0.8340
$F_Y(Y/C, Y^2, E, TR, U)$	6.7080	0.4087	0.7627	0.6874	0.7146	0.8342
$F_Y^2(Y^2/C, Y, E, TR, U)$	5.4132	0.0547	0.6789	0.6280	0.6849	0.7561
$F_E(E/Y, Y^2, E, TR, U)$	8.7011	0.0639	0.7928	0.5770	0.9524	0.5830
$F_{TR}(TR/C, Y, Y^2, E, U)$	3.1220	0.4492	0.7842	0.4938	0.8742	0.5756
$F_U(U/Y, Y^2, E, TR, U)$	8.4743	0.0011	0.2809	0.9213	0.2603	0.2294
Significant Level	Critical Values (T=40)					
	Lower Bound I(0)	Upper Bound I(1)				
1	3.8000	5.6432				
5	2.7970	4.2110				
10	2.3531	3.5412				

The calculated value of F-statistic is sensitive to selected lag. Value of F-statistic is estimated from equation (5) using OLS. The value of F-statistic exceeds UCB, reference to the critical values which were provided by (Narayan, 2005). This confirms that there is co-integration among the variables at the 5 percent significance level.

Table 4 indicates that 1 percent rise in the consumption of energy increases the pollutants by 1.0997 per cent in long run. The result was similar to the findings of (Ozturk & Acaravci, 2010)) for Turkey. The coefficients obtained for GDP per capita linear and non-linear terms are 0.2434 and -0.0543 respectively, which confirms the presence of an EKC between per capita CO₂ emissions and economic growth in the case of Pakistan. Results provide some support in favour of EKC hypothesis that the pollution level increases at starting phases with income and stabilize, and decreases. Our study findings are broadly support the views of (Shafik, 1994) and (Selden & Song, 1995) who probed an inverted U-shape association amongst economic growth and pollution.

Table 4: Long Run Estimates

Dependent Variable= $\ln C_t$	Coefficient	StdError	T- Statistic	Prob
$\ln Y_t$	0.2434	0.2510	0.9701	0.3420
$\ln Y_t^2$	-0.0543	0.0417	-1.3012	0.2061
$\ln E_t$	1.0997	0.3411	3.2220	0.0042
$\ln TR_t$	0.2413	0.1024	2.3610	0.0270
$\ln U_t$	1.1313	0.2038	5.5501	0.0001
Diagnostic Tests				
Heteroskedasticity		0.9685		
Ramsey RESET		0.0021		
ARCH LM test		0.2266		

The study found positive association between the environmental degradation and trade openness. A 1 percent rise in foreign trade was likely to increase emissions by 0.2413 percent. It might be concluded that trade enhances economic growth (income per capita) which further impedes environmental in Pakistan by increased CO₂ emission. The outcome was consistent with the findings of Khalil & Inam (2006). They concluded that the international trade upsurges CO₂ emissions.

The effect of urbanization was significantly positive which implies that higher the urban population higher is the demand for energy consumption and hence increases emissions (CO₂). On the basis of our finding, a 1 percent increase in urban population will lead to an increase of 1.1313 percent in CO₂ emissions. The study result is according to our expectations ($\beta_{U_t} > 0$).

The short run results are depicted in Table 5. The lagged ECM term has a negative and significant value at 5 percent level. Furthermore, the ECM value suggests that a change in CO₂ emissions (short to long run) equilibrium is adjusted by approximately 9 percent each year. Empirical results indicate that the consumption of energy leads to an increase in CO₂ emissions. A 1 percent increase in energy consumption increase emissions of CO₂ by 0.7337 percent. The sign of $\Delta \ln Y_t$ and $\Delta \ln Y_t^2$, shows an inverted U shape connection amongst income and level of emissions. For a country, economic growth means to environmental improvement. That is, as an economy develops economically, moving from lower to higher per capita levels, overall environmental degradation eventually falls. (Linear and non- linear) terms of income are significant at 10 percent level of significance.

The results found positive link amongst environmental degradation and trade openness and was significant at 5 percent which means that, 1 percent increase in trade would lead to in CO₂ emissions by 0.2568 percent. This confirms that trade tends to extend the size of an economy with additional production and increases emissions. And coefficient of urban population is negative and insignificant. This implies that a 1 percent rise in

urban population would lead reduce CO₂ emissions by 0.9033 percent.

Table 5: Short Run Estimates

Dependent Variable = $\Delta \ln C_t$	Coefficient	Std. Error	T-Statistics	Prob.
$\Delta \ln Y_t$	-0.5975	0.3387	-1.7639***	0.0910
$\Delta \ln Y_t^2$	0.1381	0.0696	1.9841***	0.0593
$\Delta \ln E_t$	0.7337	0.2424	3.0258*	0.0060
$\Delta \ln TR_t$	0.2568	0.0543	4.7272*	0.0001
$\Delta \ln U_t$	-0.9033	2.5875	-0.3491	0.7302
ECM _{t-1}	-0.1107	0.0257	-4.3128	0.0003
Diagnostic Tests				
R ²				0.8057
Adjusted R ²				0.6959
F-statistic				7.3377
F-statistic Prob				0.0000
Akaike info				-6.1210
J-BeraNormality				0.8815
ARCH test				0.7949
Heteroscedasticity				0.2313
Durbin Watson				1.4127

The results found positive link amongst environmental degradation and trade openness and was significant at 5 percent which means that, 1 percent increase in trade would lead to in CO₂ emissions by 0.2568 percent. This confirms that trade tends to extend the size of an economy with additional production and increases emissions. And coefficient of urban population is negative and insignificant. This implies that a 1 percent rise in urban population would lead reduce CO₂ emissions by 0.9033 percent.

5.1. Stability Test and Sensitivity Analysis

The last stage of ARDL approaches is to check the stability of model. The diagnostic tests, the LM serial correlation test,

normality of error term and the white heteroskedasticity, short run model clearly passed them. There was no evidence of white heteroskedasticity or autoregressive conditional heteroskedasticity. The Figure 1 of cumulative sum was significant at 5 percent (plots lies between the critical bounds) which depicts the stability of the parameters in the model.

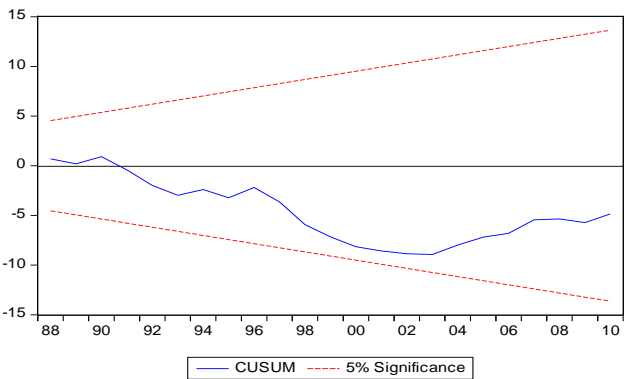


Figure 1: Plot of Cumulative sum of Recursive Residuals

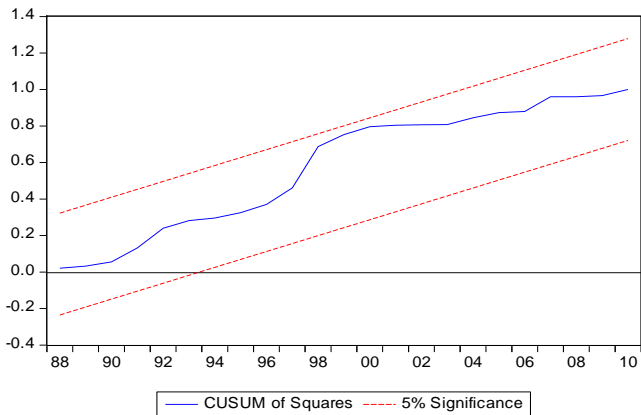


Figure 2: Plot of Cumulative sum of Squares of Recursive Residuals

5.2. VECM Granger Causality Analysis

Table 6 shows that, in long run, there exist bidirectional causality amongst economic growth and urbanization. We also found unidirectional causality from trade openness to economic growth, and from economic growth towards energy consumption, and from urbanization to trade openness.

In short run feedback hypothesis was found amongst economic growth and energy consumption. Urbanization and trade openness Granger causes to economic growth. The unidirectional causality was found from energy consumption to CO₂ emissions, from CO₂ emissions to economic growth and from economic growth to energy consumption. Overall results show that unidirectional causality was running from economic growth ($\ln Y_t$ and $\ln Y_t^2$) to CO₂ emissions in short and long run which lends support to the presence of the environmental Kuznets curve (EKC). These results were consistent with the findings of Maddison and Rehdanz (2008), Zhang and Cheng (2009) in case of China, in case of North America and Ghosh (2010) for India.

A significant of ECM_{t-1} for CO₂ emissions, economic growth and its square, and for energy consumption demonstrates the adjustment speed to the equilibrium in long run are (-0.1944), (-1.0050), (-4.4259), and (-0.1032) respectively, all equations were significant at 5 percent. The coefficient of urbanization is negative but insignificant.

Table 6: Granger Causality

Dependent Variable	Granger Causality types						
	Short Run						Long Run
	$\sum \Delta \ln Ct$	$\sum \lambda \ln Yt$	$\sum \Delta \ln Yt^2$	$\sum \Delta \ln Et$	$\sum \Delta \ln TRt$	$\sum \Delta \ln Ut$	ECM _{t-1}
	F-Statistics						Prob
$\sum \Delta \ln Ct$	.....	0.8806 (0.3480)	1.2033 (0.2727)	4.8413** (0.0278)	0.0001 (0.9918)	0.0757 (0.7832)	-0.1944 [-2.3548]
$\sum \lambda \ln Yt$	3.3932*** (0.0655)	.....	2.6924 (0.1008)	1.3226 (0.2501)	5.3541** (0.0207)	4.1725** (0.0411)	-1.0051 [-5.5833]
$\sum \Delta \ln Yt^2$	2.0260 (0.1546)	1.8842 (0.1699)	.....	1.6646 (0.1970)	2.8863*** (0.0893)	4.1450** (0.0418)	-4.4259** [-4.7902]
$\sum \Delta \ln Et$	1.1018 (0.2939)	3.1974*** (0.0738)	3.4430*** (0.0635)	.....	0.0402 (0.8410)	0.2848 (0.5935)	-0.1033** [-2.3179]
$\sum \Delta \ln TRt$	0.5100 (0.4751)	2.0240 (0.1548)	1.4606 (0.2268)	0.2273 (0.6335)	.....	4.4140** (0.0356)	
	0.3680 (0.5441)	2.5680 (0.1090)	2.8393*** (0.0057)	0.4147 (0.5196)	0.2840 (0.5940)	.....	-0.0003 [-0.0750]

Note: Significance at 5% and 10 % level is indicated by **, ***. In the parentheses is the F-statistics probability

6. Conclusions and Policy Recommendations

The findings confirmed a long-term relation between variables and gave indication in the favour of EKC in Pakistan. The significant existence of an inverted U-shape EKC reveals the effort of country to shorten CO₂ emissions. However this empirical analysis may not able to explain the actual environmental quality condition of Pakistan. The effective environmental regulations are necessary at the urban and rural levels. There is a need of strict laws and environmental taxes like green tax.

Moreover, trade openness positively affects environment quality in Pakistan. This might because of Pollution Haven Hypothesis (PHH). The outcome of this study suggest that Pakistan needs to replace dirty and obsolete technology by new and cleaner technology which will promote the production also improve the environmental quality due to technological progress, *ceteris paribus*.

The analysis of causality revealed that economic growth Granger causes CO₂ emission, also confirms the presence of EKC in Pakistan. Trade openness and urbanization Granger affects the economic growth. A rise in the level of income, trade openness, urban pollution/emissions and Granger cause economic growth thus supports trade-led-economic growth, urbanization-led-economic growth. Urbanization and economic growth granger cause one other. Whereas, short run two-directional causality was observed between economic growth and consumption of energy. Unidirectional causality from economic growth towards energy consumption was also found.

Our study findings suggest that Government of Pakistan should explore and introduce more renewable energy resources to sustain economic development and also protect the environment from depletion. More focus is required to implement efficient technologies and climate friendly policies to grow domestic manufacture and to mitigate adverse effect of CO₂ emissions and other GHG emissions on environment.

The prompt future as consequence of high urban populace does not appear to be brilliant. The principle reason is that urban populace will proceed unabated because of jobs in rural ranges. The present level of rural-urban movement is unmanageable, affecting the environment condition. Government ought to make arrangements for openings for jobs in rural ranges, finance small entrepreneurial skills in long and short run. In long-haul setting, accentuation ought to be set on human capital formation and need based skill creation.

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Structural Equation Modelling of Relationship between Teachers' Capacity Building and Students' Academic Performance in Secondary Schools in Kwara State, Nigeria

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Abstract

Unarguably, students' academic success rests on the learning experiences derived from their teachers via teaching and learning processes in the classroom. Teachers are an important tool for implementing the school programs to achieve school success. The human capital development is regarded as a way of building the capacity of teachers in the school system, thereby strengthening their knowledge and skills. In the light of this, this study examined the impact of teachers' capacity building on academic performance. Methodologically, this study adopts a correlation survey method to establish the links between constructs of the study. Stratified and quota sampling techniques were used to select 183 respondents for the study. Questionnaire method is used for the study. Students' results in five subjects (Mathematics, English, Biology, and Economics) were collected to measure students' academic performance. The data collected were analyzed using Smart PLS software to model the nexus among the constructs. Findings revealed that capacity building are provided moderately as perceived by the teachers. Also, results established that teachers who went through capacity building programs are equipped with modern techniques of teaching, thereby positively influence students' academic

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achievement. In conclusion, this study concluded that training and re-training of teachers is an essential factor for determining students' success. It was recommended that capacity building should be constantly provided for teachers with a view to boost their morale and makes them efficient and effective. Improved budgetary allocations should be made by government for teachers to attend various capacity building programs. Private and individuals should be involved in providing capacity building for teachers. Lastly, no teacher should be left out in capacity building programs as teachers remain the bedrock to students' success.

Keywords: Capacity Building, Workshop, Seminar, Teachers, Academic Performance

1. Introduction

There is a notion that teachers in Nigerian secondary schools are not discharging their teaching and non-teaching tasks efficiently. This is shown on the poor quality of students produced at secondary level of education. National Policy on Education (2004) stipulates that one of the goals of this level of education is the preparation for higher education. This goal cannot be said to have been commendably realized because the level of students who sit for matriculation exams and up failing mostly. This indicates that they are not properly prepared for this purpose which confirms that the teachers have not been able to discharge their obligation creditably. Possibly the teachers' failure to achieve these goals might be due to poor nature of capacity building they are exposed to. Capacity building practices are indispensable ingredients in the process of changing individuals and organizations from where they are to where they should be and function.

Understanding the concept of capacity building has turned out to be a buzz phrase in educational organization. It's a topic of discourse both in developing and developed countries globally and despite its universal acceptance and wide usage, the concept has been misunderstood virtually by all stakeholders in education (Ebgo, 2011; Young, 2002).

In view of this, there is a need to define capacity building to project a clear picture of what it entails in the field of education. According to (Stocklin, 2011) teachers' capacity building can be defined as the systematic process which involves subjecting teachers to intellectual activities purposely designed and meant to develop and update their knowledge with a view to translate such knowledge to the classroom activities which will have a positive impact on their students. This view is supported by (Nakpodia, 2008) who is of the view that teacher capacity building, also known as a teacher development program, is a continuous program aimed at updating the skills and knowledge of the teachers in their chosen field. Capacity building in education system is not something that can be neglected by the stakeholders; rather, it is something that should be done to promote the teaching profession.

Egbo (2011) describes teachers' capacity building in education as a diverse intensive activity outside the classroom, which teachers go through to refresh their knowledge, skills and attitude to meet up with the emerging challenges in educational system. Teacher capacity building means garnering of more experiences for professional growth. The experiences enable them to be active and work towards the achievement of the school goals. Similarly, Giwa (2012), Hallinger (2014) and Panigrahi (2012) see teachers' capacity building as the process whereby the individual teachers undergo training and re-training such as seminar, conference, workshop and lectures for the purpose of making them to be more confident, efficient and effective in the school system.

Alabi (2000) opines that teachers' capacity building connotes the needs of the teachers to improve their performance in classroom activities. She is of the view that capacity building aimed at personal and professional training of individual teachers in the school system. Specifically, the capacity building of teachers should be geared towards changes in the classrooms of the school teachers and should be a reflection of what they have gained in terms of new skills, knowledge and positive attitudinal change (Tam, 2014), the new knowledge of the teachers should also come to reflect on students improved performance in the classrooms (Giwa, 2012; Stocklin, 2011). The capacity building of the teachers

brings positive relationship between the teachers and the students, thus this ensures the efficiency and effectiveness on part of the teachers in the school (Coffin, 2008; Selemani, 2013). The quality of education depends on the type of teachers who are teaching and this requires training and re-training of teachers for the growth and development of the education system (Peter, 2011; Rahman, 2011).

Equally important, capacity building can be seen as an enhancement program which is purposely designed to upgrade the skills, knowledge and overall turnaround of the teachers in school, which will in turn, contributes positively to the teaching of students in classroom (Arinde, 2010; O'Brien, 2013). Salami (1999) views capacity building as a planned activity designed in which teachers undergo with the aim of refining them with a view to be competent and proactive in teaching. It allows teachers to acquire unique disposition, values, skills, norms, attitude, knowledge and ethic in order to prepare them for teaching challenges. It also means a kind of pre-service as well as in-service programs designed for teachers in order for them to be fully equipped for classroom activities.

Hence, it can be rightly said that the quality of professional development teachers' are open to, is a function of how rich capacity building practices they are exposed to. Teachers' profession development does not exist in a vacuum. Capacity building practices seek to enrich and undertaken in such a manner that they bring out the best out of a teacher and also add to the attainment of the goals of secondary education. Therefore, any blame allotted on the teacher not leading up to the expectation should be first channeled to the nature of capacity building practices they are exposed to. Teachers are the main instrument in educating the future generation (children) who will in turn become the national leaders of tomorrow. Teachers at any level are a significant tool for the national development. It is against the background that the study intends to find out the impact of teachers' capacity building on students' academic performance in Kwara State secondary schools, Nigeria.

Research questions of this study are

- What is the perception of teachers on capacity building and students' academic performance?
- Is there any relationship between teachers' participation in workshop and students' academic performance?
- Is there any relationship between teachers' participation in seminar and students' academic performance?

The main research objectives are to know the perception of teachers on seminar, workshop and academic achievement, to investigate whether teachers' participation in seminar influence students' academic performance, to know the relationship between teachers' participation in workshop and students' academic performance.

2. Literature Review

Past studies have been conducted on teachers' capacity building and academic performance in school. Specifically, they studied the variable as a uni-dimension which is seen as the correlation of students' academic performance in schools though some of the studies conducted in the past found inconsistent results in their various studies. For instance, Jacob (2004) in their study, worked on the relationship between teacher training and academic achievement in schools in Chicago, USA. Experimental design adopted for the study, the outcome of the findings found low significant relationship between teachers that had undergone training with academic performance of students in secondary schools. The researchers concluded that there was a need for intensive teacher training to enable them to impart positively on students they are teaching. They recommend that future studies should be conducted on teachers' training and students' academic performance.

Harris (2009) conducted study on teachers' training and academic performance in school. The outcome of the study found a significant (high) relationship between teachers that are trained and re-trained with academic performance.

Similarly, Yoon (2007) based their work on the relationship between professional developments of teachers as a nexus of students' achievement in schools. Three core subjects (mathematics, English language and science) were used to measure the academic performance of students. The findings of the study showed a significant relationship (high) between teachers' professional development and academic performance. The researchers are of the view that, teachers with adequate training would definitely improve the academic performance of their students. Future studies were recommended on the relationship between the two variables used for the study.

Pelton (2013) in his own study conducted an investigation onto the relationship between teachers' capacity building and academic achievement. His study showed a significant (high) relationship between teachers with training programs and students' academic performance. He posits that training of school teachers improves their capability in the classroom. He went further that capacity building programs organized for teachers enhanced their professionalism and makes them better in their chosen work. Further studies were suggested for future researchers.

Furthermore, Joyce (2002) explored the relationship between teachers' capacity building and academic performance. The findings of their study confirmed the existence of relationship between building capacity of teachers and academic performance. They went further that teacher capacity training does not only play a big role in the lives of teachers alone, it also has a positive impact on the academic performance of students. Similarly, Harris (2009) researched on the relationship between teacher capacity building and academic performance in Texas school. The instrument employed a questionnaire to elicit data from the respondents from the sampled schools. The outcome of the findings revealed positive (high) relationship between the two variables. The study confirmed that teachers with more professional training performed better and had significant impact on academic performance of the students they taught in the school.

In the same way, Wheelan (2005) worked on the relationship between teacher capacity building in group and students' academic performance in schools. Questionnaires were adopted to elicit information from the respondents. Results of students in Mathematics, English language and Science were used to measure the academic performance. The findings of the study revealed that capacity building in the form of group discussions improved the capacity of teachers as well as positively influenced the academic performance of students. They recommended that further research should be carried out on teachers' group discussion to see whether or not it will have a significant impact on students' academic performance.

Pradere (2007) in his own work explored the correlation between effective teacher training and students' academic performance. Mixed method techniques were used for the study. Instruments used for the study are the interview and questionnaire. T-test and analysis of variance were used to analyze the data collected from the respondents. The researcher used three subjects namely, Mathematics, Science and Reading to measure the academic performance. It was concluded that teachers with rigorous training tends to be effective and contribute positively to the academic performance of students. Koellner (2014) and Jacobs (2004) investigated teachers' workshop on mathematics and its impact on academic performance of students. Their study used an adaptive model for mathematics to teach the teachers. The researchers used the results of students who were under the teachers who received workshop training on mathematics. Their findings revealed positive (high) relationship between the two variables (independent and dependent variables). They posits that teachers' workshop on mathematics would improve the teaching skills of the teachers. Thus, it will have a positive impact on academic performance of students they are teaching. Teachers' workshops should be a continuous program for the development of the teachers in schools. They recommended studies for future purposes.

Avery (2001) also studied on the relationship between teachers' capacity building and school achievement. Their study

showed a significant (high) relationship between teachers' training and school achievement. They asserted that teachers' capacity is a correlation of school of achievement. They went further that seminars can be used for teacher training to improve their teaching knowledge and skills. They are of the view that regular training of teachers via seminars would ginger the teachers to perform well in schools. For school teachers to be productive, he/she needs training. They stressed the importance of the seminar to be an antidote to the problem of teachers in secondary schools.

Future studies were recommended on teachers' capacity building and academic performance. They worked on the relationship between teachers' capacity building and academic achievement. The study explored the training of teacher capacity building by using a seminar to prepare teachers for them to be confident and productive in the school system. The outcome of their research found that there is a significant (high) relationship between capacity building and academic performance. They averred that teacher capacity building proves to be the method of renewing teachers' confidence so as to improve their students' academic performance in schools. They are of the view that coming together of teachers to critically discuss a particular topic or subject tends to make them to be more confident in teaching. Participation of teachers in plethora of trainings is a continuous process which all stakeholders need to be taken seriously in the education system. The study recommended that future studies should be targeted on other aspect of teachers' capacity building.

Similarly, Swinton (2008) investigated the relationship between teacher capacity building (workshop) and students' academic performance. The targeted population for the study comprised of schools in Georgia, United State of America. The outcome of their findings showed the existence of significant (high) relationship between teacher workshop training and academic performance. They concluded that training of teachers has a correlation with academic performance of students. They went further that workshop programs should be provided for all the teachers irrespective of their status so as for them to be acquainted with the new ideas and innovations in education. Efforts should be

made to research in the future on the relationship between teacher capacity building and academic performance. Likewise, Alabi (2000) in her research conducted on teachers' development programs in secondary schools in Kwara State, Nigeria. She posited that professional development of teachers makes them to be aware of their responsibilities and it increases their job performance in schools. This will change the status in the school and in the society. She furthered that prompt evaluation of teacher development program should be carried out to ensure the type of training that schools are providing for the teachers.

In view of the foregoing, therefore, it can be deduced that most studies assessed teachers' capacity as a uni-dimensional variable even though teachers' capacity building can be measured by using workshop, training, conference and seminar. Literature has shown that there is less focus in using the aforesaid components to measure the capacity building. Thus, this study intends to examine whether or not the teachers who had undergone seminar and workshop perform better in the classroom. Also, there is less study on perceived teachers' capacity building in the school. Lastly, this study intends to extend the existing literature by investigating the impact of teachers' capacity building and on students' academic performance in secondary schools, Kwara State, Nigeria.

2.1. Nature and Purpose of Teachers' Capacity Building

Teacher capacity building is recognized universally in the education system to be a way of strengthening the knowledge and skills of the teachers. This is enshrined in the National Policy on Education (Federal Republic of Nigeria, 2004). According to Ogunrin (2011) and Rahman (2011), stakeholders in education must be conscious of development of teachers in school. The purpose of education is to eradicate illiteracy and this purpose must be in relation with the teacher capacity building to achieve the formal objectives in which it was established to achieve. O'Brien (2013) argues that capacity building for teachers should be about meeting the needs of the students, imparting the knowledge they have acquired to bear on them. Capacity building should be about

to know what transpired between teachers and students in classrooms.

Still, promoting teacher development enhances the thinking of teachers which is synonymous with their classroom teaching performance. It makes them to be versed and creative when dealing with students (Finger, 2015; Hallinger, 2014) posits that refreshing the knowledge of school teachers through various development programs is key to the development of education. It makes the teachers to be vibrant and composed when teaching students. However, Salami (1999) outlined the following to be the purpose of teacher capacity building in education. Specifically, in the Nigerian context, these purposes are enshrined in the National Policy on Education. They are as follows:

- To build school teachers that are well motivated for classroom activities
- To ensure that teachers are well equipped with modern skills for them to be efficient and effective
- To produce teachers with professional and intellectual background which will assist them in their teaching task
- Ensuring that teachers are fit into all social life of the society they find themselves
- Enhancement of teachers' dedication to teaching profession.

2.2. Need For Teachers' Capacity Building in School

The human development of the human being often leads to the positive result based on what he/she has learned. Building the capacity of the teachers in secondary schools is akin to the development of the students in the school. According to Mutshekwane (2014), opined that concerning the question of why there is a need for teacher capacity building in the school system. He submits that most of the teachers face a multitude of problems due to the changes in educational curriculum. The pre-service training of teachers does not guarantee the teacher competence when working as a teacher in school. He/she needs to be informed of the trends in curriculum and the need to align with the trends.

Producing good students is central to the competence of the teacher in the classroom (Asare, 2011), all teachers should be given recognition in order for them to be proactive and know that their sacrosanct input plays a vital role in nurturing their students (McFarlane, 2011).

Tam (2014) opines that teaching in school is not only pouring down the content of the curriculum alone, it depends on how efficient and effective the teacher himself. Kuyini (2011) concurred that it is based on how teacher leads and guides his students in the classroom; this notion can only be achieved if the teachers are updated. Mutshekwane (2014) and Nakpodia (2008) averred that teachers are always responsible for the implementation of curriculum in education. Teacher capacity building should be provided purposely to meet the child's need in the classrooms. It should be what is happening in the classroom, what are the students doing and what are the contributions of teachers to the students in the class.

When there is teacher capacity building, it has a plethora of benefits ranging from the benefits to the teacher himself, benefit to the school that made provision for capacity building as well as the students who benefit from the knowledge of their teachers in the classroom (Delaney, 2002). For the effectiveness of teacher capacity building in school, it must be in tandem with the needs of the individual and relevant schools. For the practical purposes of capacity building, it develops the professional competence and promotes excellence in education system (O'Brien, 2013). According to Egbo (2011), there is a general believe that teachers in primary and secondary schools in Nigeria are not well equipped in terms of capacity building. Lack of capacity building for school teachers is seen as one of the major factors contributing to the poor academic performance as evident in the results released annually by the West African Examinations Council (WAEC) and National Examination Council (NECO). Another need for teachers' capacity building in the education system is to meet up with contemporary countries in the 21st centuries in the area of education in order for the Nigerian government to achieve education for all by the year 20:20; teacher capacity building must

be propagated by the government to achieve the dream (Egbo, 2009). In support of the need for teacher capacity building in school,

According to Salami (1999), opined that the need for teacher capacity building is for them to be knowledgeable. If they undergo a series of training and re-training programs, it makes them to be a good pedagogue. Therefore, they should be able to perform the following:

- To translate what they have learned to bear in the lives of the students they teach
- To be ready for learning at all time, since learning is not static
- To be able to solve the students' problems academically, emotionally and physically
- To be capable of assisting the students to learn interrelationship and relationship learning patterns
- To be in the best position to assist their students in critical thinking to adapt systematic ways of solving the problems they encounter.

2.3. Dimensions of Teachers' Capacity Building

Teachers' capacity building as explained previously, has to do with development of teachers in order for them to be efficient and effective in the school system. The dimension for measuring teacher capacity building in the education system is In-service training (workshop, seminar, self-reading, conference and field-trip). This is very important for the actualization of teachers' effectiveness in school (Alabi, 2000; Albright, 2006; Egbo, 2009; Fareo, 2013; Iyamu, 2005; O'Brien, 2013 and Rahman, 2011). According to Baker-Tate (2010) and Burke (2009), the in-service training is the way of improving the skills and knowledge of the teachers in the education system. This in-service training is the one in vogue for the development of the teachers. The seminar is one of the dimensions of teacher capacity building which can be used to upgrade the skills and knowledge in order to have an impact in classroom activities. According to Pelton (2013), the seminar can

be defined as a group of persons coming together for the purpose of discussing and learning of exact methods and topics.

Nelson (2014) in his own definition sees seminar as a form of intellectual instruction either at an academic institution or offered by a commercial or professional organization. He opined that it is a course or subject for advanced graduates. Rahman (2011) asserts that the seminar program consists of a group of people who are meeting to discuss on certain subject in which all members of the group are expected to participate actively. The organization seminar for school teachers is to sensitize and familiarize them with the teaching skills to help them to adapt to the dynamic nature of the educational system. They were of the view that, school teachers must not see themselves as aware of all the things about teaching; there is a need for them to be exposed to the seminar program as a way of developing their capacity for them to cope with the plethora of realities in education.

2.4. Steps Involved In Teachers' Capacity Building in School

The teacher training policy seems to be the most popular policy that interests the teachers to perform better in classrooms. Motivating teachers in education system assist them to put in their best to achieve the educational goals and objectives. It allows the teachers to be well informed and creative when they are exposed to numerous developmental programs.

According to Alabi (2000) and Matachi (2006), teachers' capacity building in education system involves a systematic approach, this approach will show clearly what, when and how capacity building should be provided for teachers in school. They designed the steps involved in teacher capacity building in the education system. The steps involved in capacity building are as follows:

- *The goals of the school system* – The major goal of the school system is to impart knowledge and skills in students. It entails producing students that are well refined in both learning and character.

- *Assessment of Needs:* This has to do with knowing the areas in which teachers need for developmental programs. It also means that compiling the needs of the teachers, whether it is related to the school goals as mentioned earlier on.
- *Teachers' Development Objectives:* This encompasses the objectives of the teachers in the school system. Their objectives should be in tandem with the needs of the school. The needs of the school will continue to change from time to time. The objectives of teacher capacity building should be closely connected with the needs of the school.
- *Program Design:* This has to do with the variety of capacity development programs which are available for the teachers to upgrade their knowledge and skills. The programs are: conference, seminar, workshop, self-reading, field-trip, lectures, demonstration etc.
- *Program Implementation:* This entails implementing the designed programs by providing funding to finance teachers on various programs. The teachers are expected to be provided grants to pursue their programs for the upgrading of their knowledge.
- *Program Evaluation:* After the implementation of the dimension of the capacity building programs, there is a need to evaluate the program's to know whether the capacity building program's objectives have been achieved or not. The evaluation of the program is important to assist in future program design.

2.5. Teachers' Capacity Building: The Reality in Nigerian Context

Eradication of illiteracy in the society is a huge task that is beyond mere provision of educational facilities and curriculum. The collateral intervention should include teachers who are to ensure the practical implementation of the school programs. The success of school facilities solely rests on the nature of teachers who are recruited to the school. The school facilities and teachers should go

together for the betterment of the education system (Egbo , 2011). Regrettably, teachers’ capacity building is extremely bad compared to what is obtainable in developed countries where development of teachers is paramount to their stakeholders. Nigerian teachers are the most de-motivated as well as the most traumatized teachers on earth. These buildings cut across all levels of education; primary, secondary and tertiary institutions. Teachers are de-motivated right from the day they were recruited till when they retire after putting in 30 years active service to their father’s land. After retiring from service, their suffering continues as they will have to struggle to get their pensions and entitlements.

Sadly, the current scenario in the Nigerian education system is that the attention of training and re-training of teachers is majorly focused on tertiary institutions; less is given to secondary school teachers. Even the capacity building at higher institutions is based on nepotism, favoritism; bureaucratic bottlenecks as well as unholy politics have consumed the whole idea. Also, capacity building at secondary level is not enough for the teeming teachers who are ever ready to be educationally empowered. Teachers in secondary schools are more than the provision made for capacity building especially in public schools (Egbo, 2009; Egbo, 2011).

3. Conceptual Framework

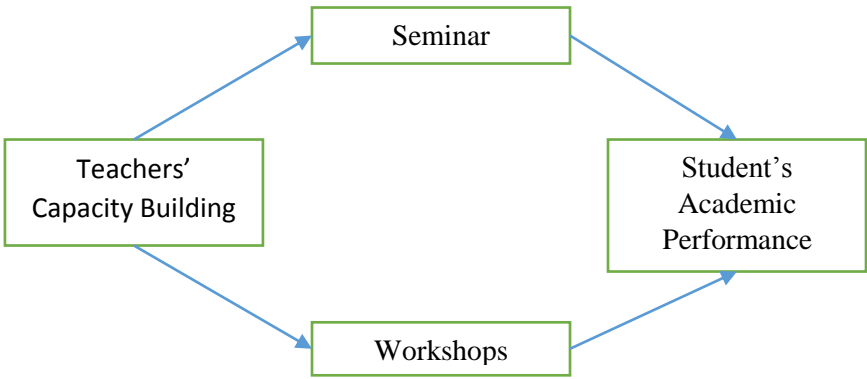


Figure 1: Conceptual Framework

3.1. Underpinning Theory: Change Theory

Change theory was postulated by John Meyer and colleagues in 1970. This theory is on the need that the more the school desires change, there is a need to take into consideration teachers' development programs for them to adapt to the change the school or organization wants. Change theory is one of the theories used in explaining the need for reform in the education system. This theory assumes that change is inevitable in the education system. The assumption is that, if teachers are trained frequently, the likelihood of those teachers trained teachers performing more than before in the classroom is high (Connell, 1995). Change theory, which is also known as change knowledge, is typically based on providing the strengths rather than problems for teachers to have expected change. Treating teachers with respect, teachers' empowerment as well as providing continuous assistance or support would minimize the possibility of having negative effects of educational change.

4. Methodology

4.1. Research Design/Population

This study adopts a correlation survey method to establish the link between constructs of the study. The population for the study consists of all secondary school teachers in Ilorin West Local Government Area of Kwara State, Nigeria. Stratified simple random sampling techniques were used to select 361 out of 6,237 teachers for the study as suggested by Krejcie and Morgan (1970) sampling table.

4.2. Instrument

The questionnaire used for the study was adapted from the previous studies as embedded in the literature review. Two questionnaires titled: "Teachers' Capacity Building" (TCB) were used for the study. Also, students' results in five subjects (Mathematics, English languages, Biology, Economics and Geography) were obtained from the selected schools to measure their academic performance. The teachers' capacity building

questionnaire was specifically used to elicit information from the teachers on capacity building programs provided. Also, the results of the students were used to measure the academic performance. Before the administering of the questionnaire, permission was sought from the school principal and an explanation was given on the need to conduct this research.

The content validity encompasses the face validation of the items so as to ensure that they measure what they are supposed to measure (Creswell, 2007). Simply put, *validity* is defined as the extent to which a concept is accurately measured in a quantitative study. To ensure the validity of the questionnaire, we seek the assistance of some experts in the field of the study. The experts were drawn from School of Education and Modern Languages, Universiti Utara Malaysia, Malaysia.

According to Creswell (2013), reliability can be defined as the consistency of measurement, or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. In a nutshell, reliability is the repeatability of measurement. In order to ensure reliability of the study, a pilot study was conducted to ascertain whether the instrument adapted for the study is good or not as suggested by the scholars. We used 70 teachers in one of the secondary schools in the state.

The pilot data was analyzed via Smart PLS (SEM) software. The software was used to ascertain the average variance extracted (AVE), convergent validity, discriminant validity and factor loadings of the constructs so as to ensure that the study can be useful for the main data analysis. After that, the main data collected were analyzed using two softwares, namely Statistical Package for Social Sciences (SPSS) and Smart PLS (Version 2) softwares were used to model the nexus among the constructs.

5. Findings and Discussion

In this study, the descriptive statistics of the latent constructs were explained in the form of mean and standard deviation for a better

understanding of the descriptive analysis of the study phenomenon. In order to achieve this, Statistical Package for Social Sciences (SPSS) was used to determine the mean and standard deviation of the constructs. According to Sassenberg, Matschke and Scholl (2011), the psychometric properties of the study's constructs were measured via a four-point Likert scale (1-4) which was based on strongly disagree to strongly agree. Also, all the items embedded in the constructs were grouped mainly into three categories. The three categories go thus: low, moderate and high respectively. Specifically, a score that is less than 2 (e.g. 3/3+ lowest number 1 is considered as a low score), a score which has 3 values (e.g. highest value 4-3/30) is taken as high, while the scores between low and high are considered as moderate .

Table 1 below shows the descriptive statistics of the latent constructs of the study.

Table 1 : Descriptive Statistics of the Latent Constructs

Latent Constructs	Mean	Standard Deviation
Seminar	3.056	0.319
Workshop	2.345	0.321
Academic Performance	3.178	0.784

The table displayed above explains the mean and standard of the constructs which ranged from 2.345 to 3.056 while the standard deviation range from 0.384 to 0.985. Meanwhile, in line with the first research question of the study, this is based on teachers' perception of seminar, workshop and students' academic performance in schools. Particularly, the analysis revealed that the mean and standard deviation for seminar are Mean=3.056, Standard Deviation=0.319. This means that teachers have a high level perception of seminar in the school. For teachers' perception in workshop (Mean=2.345; Standard Deviation=0.321), it shows that the teachers have a moderate perception on the level workshop provided for them in the school. For academic per, teachers perceived it as high (Mean=2.793, Standard Deviation=0.099), which is good for the development of the school. The charts below show the perception of teachers on seminar, workshop and academic performance.

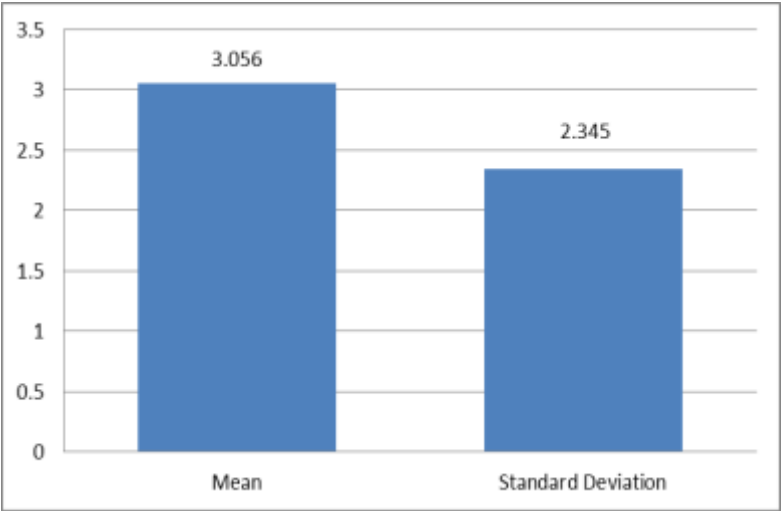


Figure 2: Teachers’ Perception on Seminar

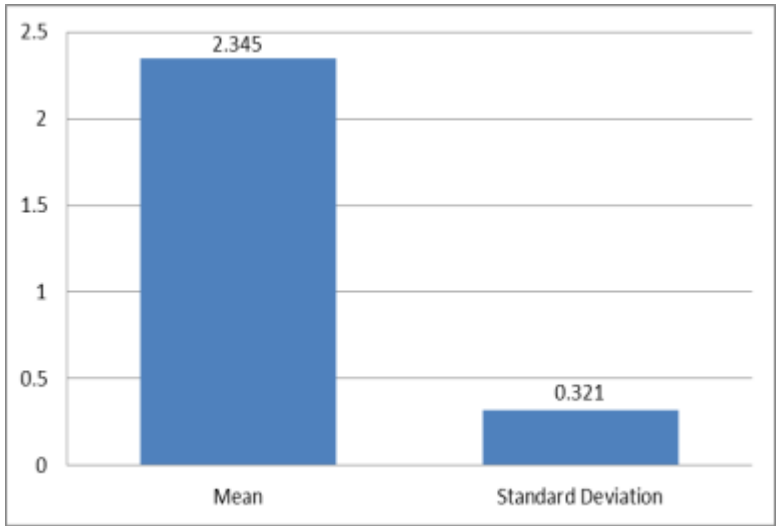


Figure 3: Teachers’ Perception on Workshop

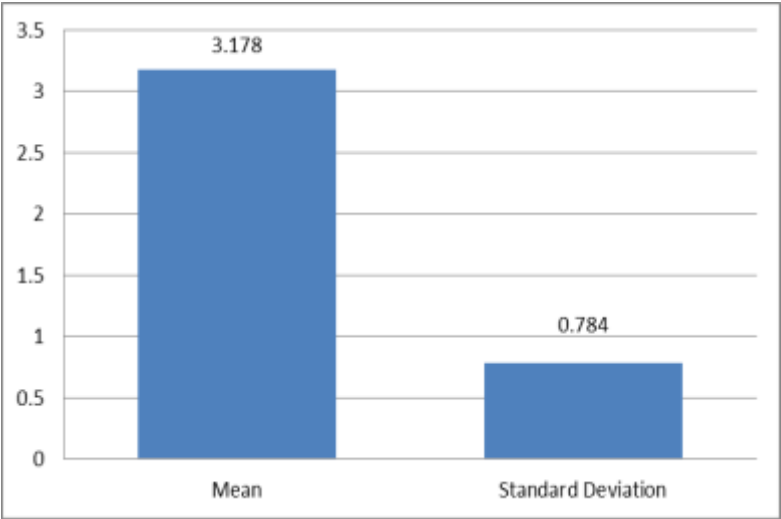


Figure 4: Teachers’ perception on students’ academic performance

5.1. Assessment of PLS-SEM Path Model Results

It is essential to make reference to a recent study carried out by Henseler and Sarstedt (Henseler J., 2013) who opined that goodness-of-fit (GoF) index is not appropriate for model validation in research (Hallinger, 2014). For example, using PLS with simulated data, the researcher explained that goodness-of-fit index is not good enough because it cannot explain the different valid models from invalid models (Hair, 2014). In the light of the foregoing about the inappropriateness of PLS model validation, this study thus employed a two-step process to analyze and report the results of PLS, as recommended by Henseler (2009). This adopted process consists of (i) the assessment of a measurement model, and (ii) the assessment of a structural model.

5.2. Assessment of Measurement Model

An assessment of a measurement has to do with establishing the individual item reliability, internal consistency reliability, content validity, convergent validity and discriminant validity as suggested

by scholars in research (Hair J. F, 2014). The figure below shows the measurement of the study.

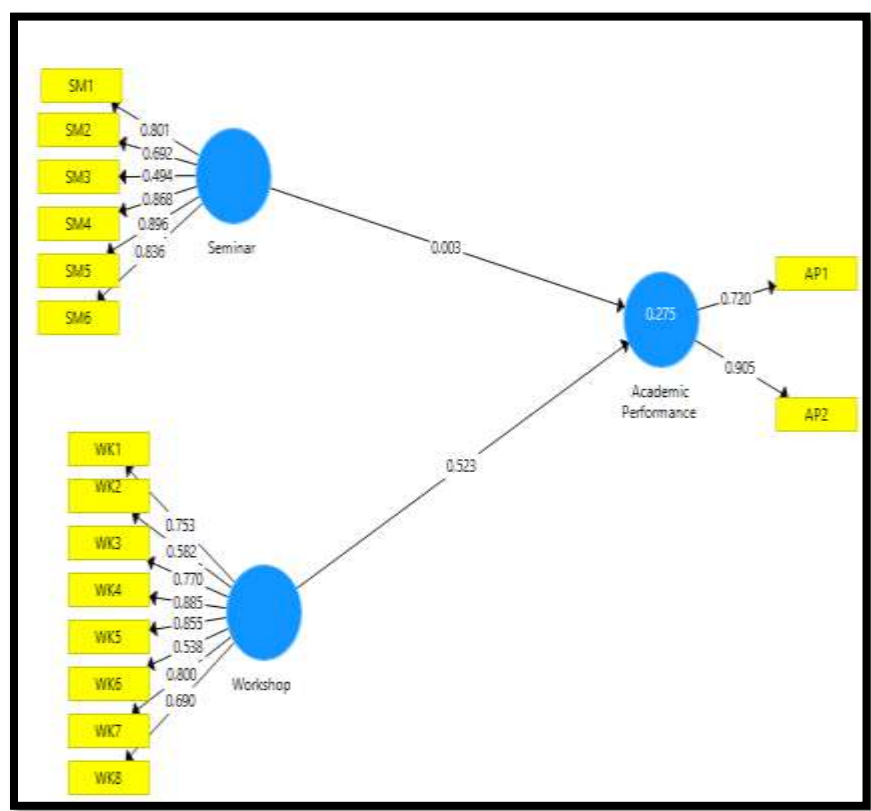


Figure 5: Measurement Model

5.3. Individual Item Reliability

In this present study, we assessed individual item reliability by examining the outside loadings of each construct's measure (Hair, 2012). Following the rule of thumb for having items with loadings, with minimum of 0.40, it was revealed that out of 21 items, 5 items were deleted and the reason is that they had loadings below the threshold of 0.40. Therefore, in the model, only 16 items were taken as they had loadings between 0.494 and 0.905.

5.4. Internal Consistency Reliability

Internal consistency reliability can be described as the extent to which all the items on a (sub) scale are measuring the same measure or concept (Bijttebier, 2000). Composite reliability coefficient and Cronbach's alpha coefficient are the most universally used estimators of the internal consistency reliability of an organizational research. In this study, composite reliability coefficient was chosen instead of Cronbach's alpha to ascertain the internal consistency reliability of the adapted instrument. Composite reliability coefficient runs a much less biased estimate of reliability than Cronbach's alpha coefficient simply because the latter accepts all items adding contribution similarly to its construct without considering the actual contribution of individual loadings (Barclay et al, 1995).

Another reason for choosing composite reliability is that, Cronbach's alpha may over estimate or under-estimate the scale reliability. Composite reliability assumes that indicators have different loadings and can be understood in the same way as Cronbach's. Though, the explanation of internal consistency reliability by using composite reliability coefficient is centered on the rule of thumb as suggested by Hair (2011), who recommend that the composite reliability coefficient should load for at least 0.70 or more. The composite reliability coefficient of each latent constructs in this study ranging from 0.799 to 0.906, with each above the minimum acceptable level of 0.70, signifying adequate internal consistency reliability of the measures used in this study.

5.5. Convergent Validity

Convergent validity means the extent or degree to which items really represent the intended construct and definitely correlate with other measures of the same construct. We assessed convergent validity by examining the Average Variance Extracted (AVE) of each of the latent construct, as posited by Fornell (1981). To achieve this, Chin (1998) mentions that the AVE of each construct should load at 0.50 or more. Following Chin's (1998) guidelines, the AVE values in this study revealed high loadings (> 0.50) on

their respective constructs, demonstrating adequate convergent validity. Table 2 below shows the composite reliability and Average Variance Extracted (AVE) of the study.

Table 2: Composite Reliability and Average Variance Extracted (AVE)

Constructs	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Students' Academic Performance	0.852	0.799	0.668
Seminar	0.863	0.898	0.604
Workshop	0.887	0.906	0.552

5.6. Discriminant Validity

This refers to the extent or degree to which a specific latent construct is dissimilar from other latent constructs (Duarte, 2010). In this study, discriminant validity was determined by using Average Variance Extracted (AVE), as recommended by Fornell (1981). We thereby compared the relationships among the latent constructs with square roots of AVE (Fornell, 1981). Further, discriminant validity was determined in line with Chin's (1998) standard by comparing the pointer loadings with other indicators in the cross loadings. The Tables 3 and 4 below explain the discriminant validity and cross loadings of the study.

Table 3 : Discriminant Validity

Constructs	Students' Academic Performance	Seminar	Workshop
Students' Academic Performance	0.817		
Seminar	0.313	0.777	
Workshop	0.525	0.592	0.743

Note: Entries shown in yellow face represent the square root of the average variance extracted.

Table 4 : Crossloadings

Constructs	Academic Performance	Seminar	Workshop
AP1	0.720	0.002	0.316
AP2	0.905	0.419	0.512
SM1	0.157	0.801	0.413
SM2	0.190	0.692	0.315
SM3	0.200	0.494	0.339
SM4	0.283	0.868	0.248
SM5	0.348	0.896	0.467
SM6	0.152	0.836	0.360
WK1	0.221	0.497	0.753
WK2	0.184	0.300	0.582
WK3	0.408	0.473	0.770
WK4	0.352	0.423	0.885
WK5	0.201	0.301	0.855
WK6	0.257	0.120	0.538
WK7	0.228	0.435	0.800
WK8	0.221	0.240	0.690

Note: Entries shown in yellow face represent the square root of the average variance extracted

5.7. Assessment of Significance of the Structural Model

Having ascertained the measurement model, the next thing was the assessment of the structural model. Before that, we applied the normal bootstrapping process to assess the significance of the model (Henseler, 2009; Hair, 2011; Hair, 2014). Therefore, Figure 6 shows the estimates for the full structural model.

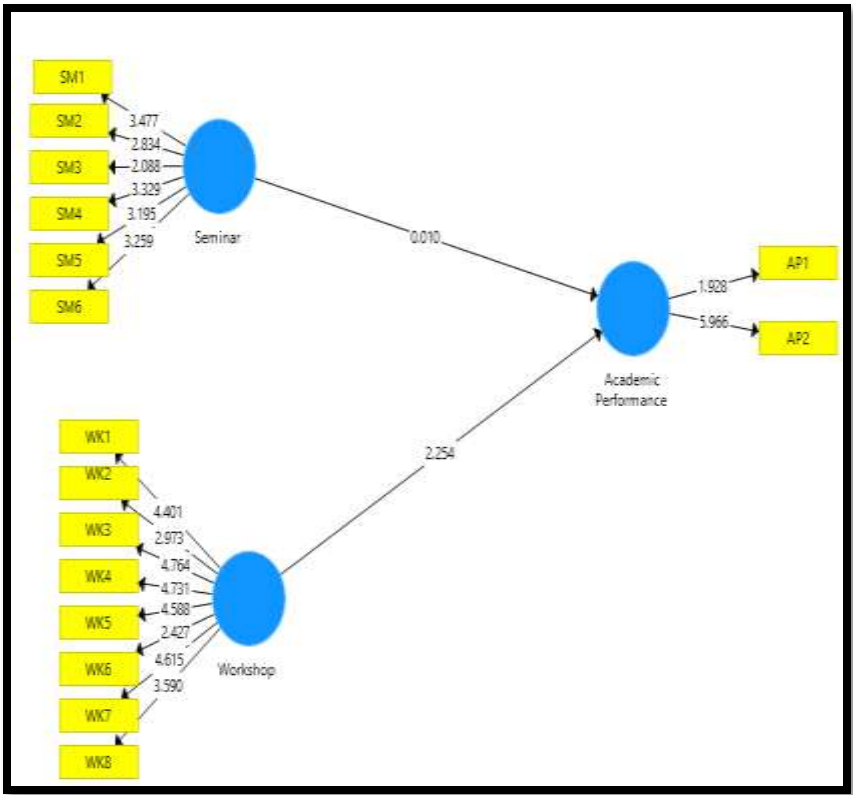


Figure 6: Structural Model

Table 5 : Structural Model Assessment

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Value	Decision
Seminar – Academic Performance	0.003	0.140	0.278	0.010	0.990	Not Supported
Workshop Academic Performance	0.523	0.480	0.232	2.254	0.031	Supported

However, concerning the research question 2, it was whether or not the teachers’ training (seminar) programmes influence students’ academic performance. In answering this question, we hypothesized that teachers’ seminar programme is

positively related to students' academic performance. Result in Table 5 and Figure revealed a negative relationship between teachers' seminar programme and students' academic performance in school ($\beta = -0.03$, $t = 0.010$, $p > 0.05$), thereby rejecting the hypothesis. Going by this result, it shows that teachers who had undergone training (seminar) do not translate to positive academic performance on the part of their students they teach in the classroom. This finding is congruent with the findings of Asikhia (2010) who found that students' academic performance is not totally dependent on the training that the teachers acquired through various development programmes, it depends on students' self-motivational factors such as self-efficacy, attentiveness, and intellectual ability.

On research question 3, it was whether or not the teachers' training (workshop) programmes influence students' academic performance in school. In response to this question, the second hypothesis stated that, teachers' workshop programme is positively related to students' academic performance. Interestingly, PLS path modeling results indicate that teachers' workshop programme is positively related to students' academic performance in school ($\beta = 0.523$, $t = 2.254$, $p < 0.025$), thereby confirming the predicted hypothesis. This result means that the teachers who acquired workshop programmes are more equipped and thus have the intellectual capacity to impact an adequate knowledge on their students in the classroom which will in turn have a positive influence on students' academic performance. This finding is consonance with the findings of Avery (2001), Coffin (2008), Selemani-Meke (2013) and Swinton et al. (2008) who found that teacher s' development is important for the development on one part, and for the success of the students on the other part.

Updating teachers' knowledge is akin to achieving academic excellence; therefore training of teachers is sacrosanct. Also, this finding has validated change theory, who postulated that providing capacity building for teachers helps them to perform better in the classroom since change is constant, teachers need to be updated from time to time to have the knowledge of 21st century as well as compete favorably with their foreign counterpart.

Furthermore, this study has contributed to the body of knowledge from three perspectives, namely practical, theoretical and methodological perspectives.

From practical perspective, this study would serve as an example on how to provide teachers' capacity building in secondary schools. Specifically, it would help the school administrators as well as government on how to provide capacity building for its teachers. More so, relevant literature shows that change theory is a well-established theory that helps to understand the importance of teachers' capacity building in school, thus change theory was included in this study for a better understanding of the study phenomenon. Methodological perspective, a broad review of the literature shows relationship between teachers' capacity building and academic performance were mainly analyzed with SPSS, therefore this study contributes to the body of knowledge by analyzing the data collected through a sophisticated software PLS-SEM, which helps to show the aesthetic beauty of the study model.

6. Conclusion and Recommendations

This study concluded that training and re-training of teachers is an essential factor for determining students' success and its importance cannot be over-emphasized, hence the need for capacity building for teachers in secondary schools. Therefore, capacity building should be constantly provided for teachers with a view to boost their morale and make them efficient and effective. Improved budgetary allocations should be made by government for teachers to attend various capacity building programs. Private and individuals should be involved in providing capacity building for teachers. Lastly, no teacher should be left out in capacity building programs as teachers remain the bedrock to students' success.

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